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THE SCIENCE TEACHER

NATIONAL EDUCATION ASSOCIATION
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CENTENNIAL

An Educated People Moves Freedom Forward

JOURNAL OF THE NATIONAL SCIENCE TEACHERS ASSOCIATION

Physiologic Response of Boys 12 to 14 Years Old to Different Breakfasts*

Carefully controlled studies to determine the effect of the size and content of breakfast on the physiologic responses of school boys 12 to 14 years of age were recently reported at a prominent medical school.

These experiments, conducted jointly by the Departments of Nutrition and Physiology, used the following breakfast regimens:

- Basic Cereal and Milk Breakfast
- Basic Bacon, Egg, and Milk Breakfast
- Mixed Basic Breakfast
- Mixed Heavy Breakfast

The first three basic breakfasts provided approximately one-fourth of the daily caloric requirement, while the fourth one provided approximately 40 per cent of the total daily caloric requirement.

* *Daum, K., Tuttle, W. W., Larsen, R., Roloff, L., and Salzano, J.: Physiologic Response of Boys 12 to 14 Years Old to Different Breakfasts. J. Am. Dietet. A. 31:4, 1955.*

The Results of the Study

There was no differentiation by way of the physiologic responses studied after the consumption of similar basic breakfasts built around bacon, eggs, and milk, and around cereal and milk.

There was no differentiation between the basic and heavy breakfasts in 12 to 14 year old boys. It seems reasonable to suppose that 12 to 14 year old girls would react similarly to the boys of the same age group.

In all other age groups, a basic breakfast providing approximately one-fourth of the total daily caloric and protein requirement is to be recommended rather than a heavy morning meal, as far as physical and mental efficiency in the late morning hours are concerned.

Nutritionally Complete for All Ages

The basic cereal and milk breakfast consisting of fruit, cereal (whole grain, enriched or restored), milk, bread and butter supplying one-fourth of the daily caloric need, is well balanced in essential nutrients needed by all ages. A basic cereal and milk breakfast is just as effective as a basic bacon, egg, and milk breakfast in promoting the maintenance of good vigor, alertness, and well-being for school boys and girls 12 to 14 years old during the late morning hours, as was demonstrated for college women and men in previous studies. Breakfast is a must for all ages!

September is Better Breakfast Month

A newly-revised Teacher's Source Book, titled "A Basic Breakfast Pattern," and Wall Chart have been prepared for Home Economics, Science, and Health Education Classes. Send for yours at once by coupon, post card, or letter for Classroom Better Breakfast Projects.

For Better Breakfast Boosters

CEREAL INSTITUTE, INC., 135 South La Salle Street, Chicago 3, Illinois

A research and educational endeavor devoted to the betterment of national nutrition

THIS MONTH'S COVER . . . symbolizes the progress of education in the United States and its constant adaptation to the demands of a changing civilization. As the National Education Association of the United States approaches its 1957 Centennial Year, the Association's headquarters at the corner of 16th and M Streets, Northwest—just five blocks from the White House—are being replaced by the handsome modern structure pictured here. Home of the National Science Teachers Association as well as other NEA groups, the new building was designed to interpret the teaching profession architecturally, and in that sense, it gives special meaning to the NEA Centennial theme: An Educated People Moves Freedom Forward.

In planning the design, the architects decided to emphasize vertical lines to achieve the most effective blending of the remodeled old NEA building and the new structure. This was done by facing the upright supporting columns with narrow bands of white marble, which is used in many of Washington's government buildings. Panels of glass appear solidly between the vertical white bands to accent the structural frame and insure maximum light. The glass is a soft blue-green, which cuts down interior glare and also eliminates a large percentage of the sun's heat rays.

Also pictured on the cover is the NEA Centennial seal, designed by Robert Kaupelis, a Columbia University student, and selected from many entries by a special committee of the National Art Education Association. The three rectangles containing the letters NEA stand for the Association's national, state, and local levels, whose unity and cooperative action are expressed by the two keys. The two pillars signify education and democracy, NEA's goals.

The NEA Centennial Year program is outlined on page 241 of this issue.

Readers' Column

It is with pleasure that I write in behalf of my students who took part this year in the Science Achievement Awards program of the Future Scientists of America Foundation.

It was my first year, as well as theirs, so it was doubly pleasing to have so many of my students win recognition in this program. Many more are planning now for next year's program, and I'm certain that they will gain much in their experience.

I hope you will convey our appreciation to the American Society for Metals and those people who contributed so generously of their time and effort to make the program possible. It has proved to be the one BIG moment of our science program for this year.

As for the NSTA itself, since I joined the organization a few years back, the services certainly have been expanded in an enriching way. I also find *The Science Teacher* helpful as well as interesting and look forward to its issues.

My congratulations to all of you for the splendid work and guidance of the Association.

WALTER P. LARTZ
U. S. Grant School
Sheboygan, Wisconsin

Mark This on Your NSTA Calendar

THE NATIONAL CAPITAL AREA WORK CONFERENCE ON SCIENCE FAIRS, to be held at Camp Letts, Edgewater, Maryland next month—October 11-13—is being planned for educators and science teachers who see in the science fair a valuable means of stimulating scientific interest in students at all levels. The regional work conference, which is open to all interested educators and science teachers, will help educators initiate new fairs and improve existing fairs, and give impetus to science-education activities in general. Members of parent-teacher groups and representatives of the communications media are also urged to attend the conference, which is endorsed by colleges, universities, and boards of education in the Maryland and Washington, D. C. areas.

The conference is being arranged by the Joint Board on Science Education of the Greater Washington Area (the host organization) and the Oak Ridge Institute of Nuclear Studies, in cooperation with NSTA and other professional associations. For further information, write the Information Department, Oak Ridge Institute of Nuclear Studies, P. O. Box 117, Oak Ridge, Tennessee.

THE SCIENCE TEACHER

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MEMBERSHIP

The membership year coincides with the calendar year. New entries during the fall months extend through the following calendar year. Library and elementary school subscriptions coincide with the school year or run for one year from date of entry.

Active Membership	$4.00
Sustaining Membership	$6.00
Student Membership	$2.00
Library Subscription	$5.00
Elementary School Subscription*	$5.00
Life Membership	$100.00

(payable in annual installments of $10.00)

* Includes the *Elementary School Science Bulletin* in quantity lots.

Coming . . .

in the October issue of *The Science Teacher*

- Science—The Endless Adventure
- A Saturating Core Reactor for the Physics Laboratory
- Development of High Level Science Talent
- Insects in the Classroom

Editor's Column

As is our practice, this column will from time to time be turned over to "guest editors" during the school year. We are happy to bring to you this month a message from the new President of the Association. Are there others whose views on problems and issues you would like to hear?

Editor.

The graduates of today's schools face economic and social problems of continuously increasing complexity. These problems are so enmeshed with scientific and technological developments that no one can draw a definitive line to separate them. The responsibilities upon our teachers transcend by far the tasks of yesteryear when teaching was conceived in a much simpler pattern.

It is significant in the life of our Association that the Board of Directors at our 1956 annual meeting took action authorizing a Legislative Committee. This new committee is charged with the responsibility for continuous study and review of state and federal legislation and proposed legislation that has a bearing on the teaching of science. This action is not without precedent among professional and learned societies, and it *does* serve notice that our Association conceives of its functions on a broad basis. We are now committed officially to a concern, not just with the details of the scientific house in which we live, but with the total architectural pattern of our house, its relation to the other buildings, and indeed with the community in which our house has been built.

The implementation of this policy will not, and perhaps should not, be a matter of abrupt action. But the steady attention of our membership to those matters of social and economic concern in so far as the teaching of science is concerned is entirely warranted; to act otherwise is to retreat from reality in a fashion unworthy of the teachers of vigorous youth.

This course of action requires the constructive efforts of all of us who have a responsibility for science in the schools. For each of us this means an alertness to matters of social and economic concern and advice to our governing Board of Directors to assist in its work. Through persistent and careful work our Association can contribute even more effectively to the most critical of all our enterprises—the education of our young people.

Turning rather abruptly to another subject, I want to take this opportunity to express my hope that the year ahead will be a pleasant and productive one for every member of NSTA. To help make this hope a reality is one of the Association's primary goals and we constantly seek better ways to aid science teachers in meeting today's varied and widespread problems and responsibilities. But we want and need your continuing advice, criticisms, and suggestions for the best ways of strengthening our efforts. Please let us hear from you.

John S. Richardson

NSTA President, 1956-57

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The National Science Teachers Association is a department of the National Education Association and an affiliate of the American Association for the Advancement of Science. Established in 1895 as the NEA Department of Science Instruction and later expanded as the American Council of Science Teachers, it merged with the American Science Teachers Association and reorganized in 1944 to form the present Association

Problem Solving THE PRECIOUS GEM IN SCIENCE TEACHING

By ROBERT STOLLBERG*

San Francisco State College, California

Objectives of Science Teaching

SOME ONE—it makes little difference who—once observed that if a dozen experts were asked about the state of the nation, the interviews would produce at least thirteen different opinions. The extra statement, it seems, would have come from one specialist who changed his mind before the consultation was finished.

Are we in science education as guilty as the fictitious panel of experts in the foregoing illustration? Do we literally wander off in all professional directions at once? To what extent are we without consensus concerning our methods of teaching, our standards of achievement, and the objectives of our educational endeavor?

Of course there are dissimilarities among science education credos stemming from various sources. Sometimes these reflect basic differences—possibly severe conflicts—in fundamental educational philosophy. But more often, the divergence of purposes in science teaching evident in the literature is traceable to differences in emphasis, in approach, or relationships among objectives. Some of these differences are matters of semantics—some are no more than different ways of expressing opinions—possibly merely varying degrees of eloquence!

Now differences—large and small—among the expressed objectives of science educators are significant. But they are no less so than the sometimes striking similarities which exist among the statements. Even a superficial survey of the literature reveals some remarkable patterns of concurrent thought. Some phrases appear repeatedly—among them: major generalizations of science, social implications, problem-solving, interests and appreciations, leisure time, and occupational opportunities, useful skills, and scientific aptitudes.[1] The writer has elsewhere attempted a brief synthesis of assorted statements of objectives of elementary school science education.[2] Excerpts from this survey are:

(1) As a result of elementary science education, students should habitually and skillfully employ thinking habits (scientific methods) in solving problems in the daily walk of life. They should also exhibit reasonably mature points of view (scientific attitudes) related to tolerance, curiosity, honest doubt, and the like. . . .

(2) As a result of elementary science education, students should accept the role which science plays in modern living. They should realize that science and humanity are intimately interrelated, and that the doings of each affect the other. They should understand how scientific advances alter our ways of living, and how society increasingly depends on scientific information and methods to meet the public need. . . .

(3) As a result of elementary science education, students should develop and enjoy personal interests, some of which are related to science. They should recognize and enjoy some scientific aspects of their natural and man-made environment, and should appreciate and respect the efforts of those who have made the latter possible. They should be in the process of developing a personal philosophy based on truth, understanding, and logic, rather than one based on superstition, intuition, and wishful thinking. . . .

(4) As a result of elementary science education, students should base their opinions and decisions and actions on some background of concepts and principles in the field of science. They should not only carry on sound thinking, they should have a fund of reliable knowledge with which to think. They should also be able to locate needed science information which is beyond the limits of human memory. . . .

* Based on a talk given at the Elementary Science Section of the Second National Convention of NSTA, Chicago, Illinois, April 2, 1954.

[1] *A Half Century of Teaching Science and Mathematics*, Central Association of Science and Mathematics Teachers, pp. 153-162. Menasha, Wisconsin: George Banta Publishing Co., 1950.

[2] Stollberg, Robert, "The Place and Purpose of Science Education in Elementary Schools", *Metropolitan Detroit Science Review*, February, 1952; pp. 26-28.

It is tempting to ask, "Which is the most important objective of science in the elementary school?" This may be akin to asking which is the most important wheel of an automobile. But if forced to make a choice, the writer would place his greatest emphasis on the first of the four objectives stated above: *problem-solving,* by whatever name it might be called.

The Role of Problem-Solving

It should be made clear that the "problems" referred to in this phrase include far more than merely numerical problems. The problems—perhaps difficulties is a better word—which beset boys and girls and men and women range from finding a good way to care for the lawn to maintaining normal weight; from getting a date with a girl to deciding which one to marry; from fixing a broken toy to voting for President. There are small problems and great ones, difficulties confronting individuals and difficulties confronting groups, short-lived challenges and problems which we face for years or generations. They are, in a very real sense, the grist of the mill of daily living.

Needless to say, the number of questions of importance to humanity is immeasurably large, if not mathematically infinite. To many of these questions, no final answer is known. Aside from these obstacles, we know that the results of memorization — unless repeatedly used — are appallingly short-lived. Is it possible to steer a sound course among the shortcomings of merely factual learning? Can practical education be conceived as teaching youngsters a thorough understanding of a limited number of the solutions to the most important problems they will face? Such an effort would at best be but a fragmentary preparation for living. The truth of the matter is, we do not know what problems will be encountered by our students—not even next week, to say nothing of a generation from now.

What adult today had teachers or parents who could foresee the problems now encountered by all of us? Who could have predicted that society would be wrestling with predicaments such as overloaded highways, smog, and the control of nuclear energy? Who could have imagined that individuals would be wondering whether or not tobacco has any relation to the incidence of cancer, or how to adjust one's pattern of living to the persistent phenomenon of television? And if these problems could have been foreseen, who could have provided the answers for the careful study of the school children of yesteryear? And are we not still in the same predicament? Are we better able than were our parents to foresee the problems our students will face a generation hence? How can we provide answers to questions which escape the imagination?

It seems abundantly evident that the goal of education for living can be no more than partially realized by a mere acquisition of facts, principles, and generalizations. Merely a fund of information is of unquestionable value. But children and adults must be able to find information—forgotten facts, unlearned principles, and new ideas. They must be able to interpret available knowledge, to use reason, and to make value judgments. In short, they must be able effectively to approach new problems as they are encountered. It is this sort of behavior which is meant when the term *problem-solving* is used. It is this argument which leads the writer to refer to it as "the precious gem of science teaching."

The Facts of Classroom Life

There can be no doubt that teachers in elementary and secondary schools are rather dependable in admitting that science instruction has a responsibility for problem-solving education. This is evident from their courses of study and from their lists of avowed objectives. But if one examines the day-to-day teaching in typical classrooms, or analyzes teachers' evaluation of science teaching, the inferences are most discouraging. Barnard[3] describes a survey in which:

"Objectives related to scientific attitudes and scientific methods were commonly listed in the courses of study. Teachers in the schools observed were asked how they taught for these objectives. Their responses indicated some teachers believed that a study of science automatically resulted in the achievement of these objectives; that it is not possible to teach young people to think; that an occasional lesson on critical thinking is adequate; or that young people learn the attitudes and methods of science by observing the teacher. A more recent study dealing with one element of scientific method indicated that progress, both in textbook writing and classroom practices, toward adequate consideration of scientific methods is extremely slow."

The comments quoted are aimed chiefly at the secondary school level, and the studies mentioned span nearly two decades. The description, however, can also be applied to the situation in elemen-

[3] Barnard, J. Darrell, "Teaching Scientific Attitudes and Methods in Science," *Bulletin of the National Association of Secondary-School Principals*, January, 1953; 180.

tary schools. This important objective of science education is receiving little more than lip-service. Our "precious gem" is being sadly neglected!

What's in a Name?

The educator's lexicon is well supplied with near-synonyms for what has on these pages been called problem-solving. The fact that such a variety of terms exists is indicative of confusion concerning the nature of problem-solving, or whatever it may be called. Perhaps more important still, the inconsistency of nomenclature breeds still more confusion among teachers.

Perhaps there is no one term which is distinctly superior to all the others. If there were, it might have been adopted long ago. The writer suggests that the word *method* is misleading, since it may (and all too often does) lead one to believe that there is one best method of scientific procedure. Again, the term *scientific* may have some shortcomings; it suggests that the "thing" it describes is for use by scientists only—or at best applies only to the solution of scientific problems. Even the word *problem* may be inappropriate. Perhaps it tends to restrict the process to major problems bordering on research. Any phraseology which tends to confine the application of sound thinking to technical fields, or removes it from the walks of everyday living, would therefore be undesirable. The same would be true of terms which suggest that the process is only for the intellectually elite. At least it would appear that this is the case throughout the field of general education. And this, without a doubt, includes the elementary school.

The writer ventures that a solution to the nomenclature problem might be found in a longer set of words, rather than a single or hyphenated word. It is suggested this highly desired trait is simply *the ability to find out what you want to know, and to do something worthwhile with it once you have it.* It is a big mouthful, unfortunately. But it could be condensed in the manner of that recent expression of confidence in one's own ability —"can do." Perhaps we can call our precious gem by the unlikely but expressive term, "can-find-out-ability."

What It is Not

By whatever term it may be called, this problem-solving-ability, this can-find-out-ability, is the center of a great deal of conflicting comment. Some of the misconceptions have a consistent pattern of recurrence. The writer respectfully suggests that there are some things which problem-solving is *not*. Among them are:

(1) IT IS NOT THE PRIVATE PROPERTY OF SCIENTISTS. Everyday, people of all ages find themselves confronted with an almost endless array of problem situations. To borrow a quote from Conant, "These may range from a determination to buy high-test gasoline rather than a cheaper grade, to the making up of one's mind to sign a petition to outlaw the atomic bomb. Or, if you are in a responsible position in the affairs of this highly industrialized world, you may have to vote yes or no on a proposed loan for the purpose of building a pilot plant to make a new product or a new machine."

A study carried on at The Ohio State University illustrates that these daily-life difficulties are confined neither to technical problems nor to adults.

(2) IT IS NOT A SERIES OF FIXED STEPS. Probably more often than in any other way, problem-solving is described in science textbooks as a series of steps. These may be from three or four to eight or ten in number. They sparkle with phrases such as "state the problem," "gather facts," "set up hypotheses," "experimental evidence," and the like. Are we to believe that typical scientists follow such a lock-step pattern? Do they say, "How, having exhausted the literature in my problem area, shall I produce a hypothesis?" It is at least an even chance they had one or more hypotheses—and possibly pretty good ones—long since. Many scientists seem to leap completely around familiar patterns of thought. With an ephemeral insight (a respectable name for a hunch) they may capture a glimpse of a distant truth. Sometimes their findings are the result of sheer discovery, and possibly even of accident.

Like problems of scientific research, the every day difficulties of the layman defy conformity to a specific pattern of procedure. Also they are usually incomplete. Should we carry on a complete investigation of which suit to buy, when to go to the movies, or how to spend our vacation? If we did, we'd never get the clothing, the entertainment, or the holiday. Must we test hypotheses concerning who is the best plumber to fix our broken water tank, or whether or not to call a doctor? It is ridiculous to suppose that we must be thorough in solving such problem situations.

(3) IT IS NOT COLD, DISPASSIONATE, AND DETACHED. We often conjure up for our students (and ourselves) the notion that the scientist is an impartial and disinterested participant in his problems. And we sometimes suggest that young people, in meeting their daily difficulties, should

"go and do likewise." Actually, as Conant points out:

> "The notion that a scientist is a cool, impartial, detached individual is, of course, absurd. The vehemence of conviction, the pride of authorship burn as fiercely among scientists as among any creative workers. Indeed, if they did not, there would be no advance in science."

Do scientists want their experiments to "come out right?" Of course they do! Most of them depend on productivity for recognition, position, and remuneration. Most of them also depend on productivity for personal satisfaction. Why shouldn't they want to substantiate hypotheses, to verify predictions, to unfold hitherto unknown relationships?

A characteristic of a true scientist is not that he is without emotions about his work. Rather, he does not permit his feelings, his hopes, his needs to interfere with the integrity of his work. In a similar way, we should not encourage young people to be without personal feelings as they encounter problem situations. Instead, we should lay emphasis on keeping the feelings out of the findings, so that the value of the results of finding out will not be jeopardized.

What It Is

What, then, is problem-solving? What do we mean by "can-find-out-ability?" How can we properly describe our "precious gem of science teaching?"

Problem-solving may be thought of as a general type of human behavior. It includes an assortment (not a pattern) of skills and attitudes and habits. Among them are skills such as asking meaningful questions, using indices effectively, reading with speed and comprehension, observing carefully, recognizing problem situations, and inventing and testing tentative solutions for them. Also present are attitudes such as being tolerant of other people's opinions and open-minded about new facts and ideas, and being on the one hand willing to withhold conclusions until plenty of information is available, yet on the other hand willing to draw tentative conclusions on the basis of insufficient information when this is required. Included too, are the habits of being curious and thorough and careful and personally well-organized, as well as the habit of using skills and attitudes.

The above is not intended as an exhaustive listing of the ingredients of effective problem-solving behavior; it is suggestive only. Nor should one conclude that knowledge *per se* is not involved. The individual who has reasonable command of certain well-selected facts, important principles, and broad generalizations related to his "problem" can arrive at a better conclusion and do it quicker than the person who is not familiar with the general field of his difficulty.

Teaching It More Effectively

If problem-solving or "can-find-out-ability" represents a type of behavior useful to all boys and girls and men and women, then educators should be concerned with what to do about it. How shall we go about the teaching of problem-solving ability?

The field of educational psychology, it appears, has much to offer toward this end. For example, we know that the teaching-learning process can occur through *precept*, through *example*, and through *experience*. Children learn by precept when they read or are told about how they should approach problem situations. They learn by example when they read or hear stories about how people—scientists, among others—have handled their difficulties. Learning by example is also involved when youngsters see well-presented demonstrations and experiments in school, or when they "look over the shoulders" of their classmates who are tackling some problem situation. Children learn problem-solving by experience when they participate, personally and directly, in a "find-out" kind of activity. If we are to take a tip from the educational psychologists, then, we would employ all three of these avenues of learning.

But our knowledge of the teaching-learning process also includes the notion that these three avenues of education tend to be increasingly valuable in the order mentioned. Of course there are exceptions, but the heirarchy of effectiveness highest for experience and lowest for precept seems to be particularly valid for younger people, and for the vast majority who are not favored with exceptional intelligence. This concept would indicate that we should accentuate direct, participative experience in our educational method, and should perhaps reduce the effort devoted to learning by precept. How tragic it is that many school situations seem to be precisely the opposite!

Educational psychology also reminds us that children learn best those things which they find both interesting and important. This is one of the many reasons why modern educators show such concern over the needs and interests of their students. To many this doubtless appears as a clumsy

(Please continue on page 257.)

Scientists and Musicians

By BENJAMIN J. NOVAK

Vice-Principal, Frankford High School, Philadelphia, and Lecturer in Secondary Education, Temple University, Philadelphia

and GLADYS R. BARNETT

Music Education Student, Temple University, Philadelphia

NOWADAYS PEOPLE ARE MORE SOPHISTICATED, perhaps, in their notions about scientists as people. Certain stereotypes, however, still exist. Possibly scientists are no longer regarded altogether as being pipe-smoking, smock-clad, bespectacled, and anti-social. In matters of the heart and spirit, though, the scientist is still often thought to be inhuman, extra-human, or at least a little atypical. The scientist passes too commonly as a mechanistic empiricist and pragmatist, denying emotion, and unimaginatively analyzing phenomena and human experience according to deductive and inductive logic. How often do people forget that great scientists of all eras have used reflective thought and great powers of imagination to open large vistas for successful exploitation with intelligent application of scientific method?

Scientists have at times been at odds with theologians, usually depending upon the area of research pursued. Some, like Gregor Mendel and Joseph Priestley, have served as clergymen with no apparent conflict to their scientific work. A still rather popular misconception prevails that the study of science leads inevitably to weakening of religious faith, or worse. Scientists vary, of course, in their personal belief, but few presently accept a mechanistic, impersonal universe. Many scientists, in fact, cite the strengthening of their religious conviction as they explore their natural and physical environment. Speculation on this subject is not, however, the purpose of this paper.

A more stubborn stereotype surrounds the scientist with regard to art and music. People question how an impersonal, objective, and apparently unimaginative person finds and expresses the emotions inherent to such pursuits. Many were the quizzical looks and remarks when the senior writer was for a time engaged as the head jointly of the science and music departments in a large urban high school. Many persons regard the assignments as being obviously incompatible. The information in this paper will suggest a broader view.

It is important, moreover, that the science teacher, in common with all other instructors, recognize many interest and aptitude patterns, in order to provide more intelligent guidance to his students. The senior writer recalls early in his high school teaching experience, a student who manifested outstanding talents divided almost equally between chemistry and music. His later career has followed an apparent wasteful vacillation between the two interests. A more informed teacher might have been of more constructive help in this and similar situations. Every student in a science class will not become a scientist, but upon what better a foundation than a study of science can he arrive at a choice of a career? First, one can scarcely suggest an occupation which is not indebted to scientific discovery and application. Second, the science teacher should be equipped to assist the student in learning the techniques of making sound choices, when the latter finds he is faced with reasonable alternatives in deciding on a career.

Musical aptitude seemingly is a somewhat specific trait that may or may not be found in association with scientific aptitude. Profiles showing interest patterns expressed by men following various occupations as described in the manual of directions for the Kuder Preference Record[1] indicate that chemists as a group scored at the 59th percentile in musical interests. Other scientific occupations (based on few cases) recorded in the manual do not show a very strong choice of musical interests. There is considerable variation among individuals. In keeping with the findings that gifted persons often have many talents, a number of people have the potential to excel in both science and music. Generally, however, one talent tends to subordinate the other.

The average person will admit readily that the scientist contributes heavily to music in acoustics,

[1] *Kuder Preference Record.* Science Research Associates; Chicago, Illinois.

INTERNATIONAL NEWS PHOTOS

An unhappy violin student at the age of six, Albert Einstein later found great relaxation and comfort in playing the instrument.

music hall construction, manufacture of musical instruments, recording, and amplification and transmitting devices. Thus, scientific "magic" enables violinist Jascha Heifitz to play two violins on a single recording. Caruso's voice is lifted out of a forty-year-old record, the scratchy piano accompaniment eliminated, and re-recorded with a modern orchestral background. Engineer hobbyists building their home "hi-fi" sets are the envy of their neighbors. All of which is interesting, but these accomplishments are those of technicians, not necessarily of creative musicians.

A perusal of biographies of scientists and musicians shows interesting relationships. Many musicians, early in life had other vocational goals, for various reasons. Not a few began preparation in science, then turned to music.

Some Started in Science

A number of case histories show a turning from science to music because of economic considerations, stronger interests, pressure of friends, and other less defined factors. Could some of the shifting be attributed to ineffective guidance or lack of inspiration in science teaching? With regard to the cases cited below it can be argued that they represent people who were only temporarily misdirected from music, and if they had not eventually become musicians would not have been scientists either. This point of view is highly debatable in some of the cases.

Ferruccio Tagliavini, the contemporary operatic tenor, was determined to study engineering, until he was persuaded to enter a singing contest. Sigmund Romberg was a reluctant engineering student at Vienna's Polytechnic Institute, cutting classes in favor of musical pursuits. Ezio Pinza, the basso, was also a most recalcitrant student of engineering, quickly abandoning it by choice.

Frank Black, who for many years was musical director of the National Broadcasting Company, was a chemistry major in Haverford College. Upon graduation he made a choice of a position as a pianist instead of a chemical engineer. Charles Courboin, the eminent Belgian organist, was an engineering student until 18 years of age. Charles Kullman, an important tenor of the Metropolitan Opera Company, graduated from Yale as a premedical student, having sung in the glee club. Financial difficulties, coupled with coincident vocal opportunities, caused him to shift his objective.

Rudolf Laubenthal, a heroic German tenor, successful in Europe and with the Metropolitan Opera before the rise of Lauritz Melchior, had intensive scientific training in Munich, Strassburg, and Berlin. While studying medicine in Berlin, the beauty of his voice was recognized, and he was persuaded to choose music as a career.

Alfred Piccaver came to Albany, New York from England as a small child. He worked as an engineer under Edison, but his vocal hobby won recognition, and he was a famous tenor in Europe for over two decades. Leo Slezak, the magnificent Moravian-born tenor, also started as an engineering student, but his voice soon led him to the operatic stage and motion pictures. His son, Walter Slezak, is well-known in Broadway musical comedies and American films.

John Charles Thomas, the American baritone who attained eminence in opera, concert, and radio, pursued medicine in Carlisle, Pennsylvania and in Baltimore until diverted with the winning of a scholarship to the Peabody Conservatory in Baltimore.

Ernest Ansermet, a contemporary Swiss conductor of renown, divided his studies between mathematics and music in Lausanne before concentrating on music. He taught mathematics for a time at the University of Lausanne before turning to music as a career.

Joseph Hofman, the unsurpassed pianist and director of the famed Curtis Institute of Music in Philadelphia, had strong scientific and mechanical interests. As a child prodigy beginning at seven years of age, he had little opportunity even to consider science seriously. As an adult he had a home workshop and laboratory, where, among other things, he designed a home oil-burner, air springs for an automobile, built a steam car, and designed a model house, the foundation of which could rotate with the sun.

Kurt Atterburg, an eminent contemporary Swedish composer and conductor, was trained as an engineer, working in this capacity at the Stockholm Naval Station. For some years he served in the Register Bureau at the Royal Patent Office, while also continuing musical pursuits. A government subsidy eventually permitted him to give up engineering in favor of music.

Three great musicians show a clear influence by parents who were scientists of talent. The father of Fritz Kreisler, the distinguished violinist, was famous as a physician and an ichthyologist. Ernst von Dohnanyi, the prominent Hungarian pianist and composer, was introduced to music by his father who was a cellist, as well as being a professor of mathematics and physics in the local high school. Nickolai Miaskovsky, the Russian composer, also had a father who pursued music as a hobby while working as an engineer. Nickolai himself worked for a time as an army engineer before turning full-time to music.

Others Stayed in Science

An impressive number of our scientists representing all fields of specialization have strongly developed avocational interests in music. Thus, some perform in vocal or instrumental groups, conduct, or play the organ at various levels of proficiency. Many unquestionably have the potential to become first-flight singers, instrumentalists, or composers, but since the majority do not exploit their talent, people are not readily convinced of its high level. Thus, people like Dr. Eli Marcovitz, a successful Philadelphia psychiatrist, plays the violin for his private satisfaction with several musicians from the Philadelphia orchestra.

Albert Einstein was assigned, not too happily, to the study of the violin when he was six years of age. He awakened musically with the hearing of some Mozart sonatas at the age of thirteen. Thereafter, the violin was a great relaxation and comfort. The friends and guests before whom he occasionally played attest to his virtuosity.

Dr. Albert Schweitzer is a many-sided giant in music, philosophy, religion, and medicine. His maternal grandfather, J. J. Schillinger, was a brilliant organist and teacher. Albert's father started giving him lessons when he was only five, and by age nine he could play his grandfather's organ. Schweitzer has become an organist of world renown, and is especially noted as a performer and biographer of Bach. Dr. Schweitzer's medical missionary work in Africa has been aided financially by his organ recitals. Friends have provided him with a piano and an organ constructed especially for use in Africa's climate.

Probably the most glittering combination of scientist, teacher, and musican is to be found in the person of Alexander Borodin. He was born in St. Petersburg (now Leningrad), Russia in 1833. After his graduation from the Academy of Medicine and Surgery, he taught chemistry there, besides being a practicing physician and writing papers and books. Borodin was one of the pioneers in education for women, and helped to organize the first medical school for them in Russia.

As a child Borodin studied the piano, later playing the 'cello and flute in chamber-music groups. When he was thirty, he married a concert pianist who joined with his teacher, the distinguished Mily Balikirev, and others, in urging him to do creative work in music. Under this prodding, Borodin composed a symphony during moments that could be spared from teaching. His opera, the famous "Prince Igor," composed under similar circumstances, is popularly recognized in many of the melodies which have been used in the current Broadway musical "Kismet." His second symphony and the symphonic poem, "In the Steppes of Central Asia," are other masterpieces. Borodin said of himself: "I am a Sunday composer who strives to remain obscure." This was not to be, of course. He is regarded by competent authorities as being one of the most gifted composers of the nineteenth century, joining with Balikirev, César Cui, Modest Moussorgsky, and Nicholas Rimsky-Korsakov as the famous "Mighty Five" of Russian music.

A Dedication to Teaching

How often is it said, "One must be dedicated to his work." Many musicians deplored the "waste" of Borodin's musical talent in favor of science and teaching. There is little question but that Borodin's choice deprived the world of much inspired music. So it is with all persons of many talents. Some

can never be utilized fully. As for Borodin, he apparently had no regrets. He might possibly subscribe to the thought that great achievers in most fields pause for shorter or longer periods to transmit their skill and inspiration to those who follow. How else, indeed, does one achieve immortality save through his offspring, or through those whom he teaches?

How clear is Borodin's dedication: "For my colleagues in music, it is their chief business, their occupation and aim in life. For me it is a relaxation, a pastime, which distracts me from my principal business, my professorship. . . . I love my profession and my science. I love the Academy and my pupils. My teaching is of a practical character, and for this reason takes up much of my time. I have to be constantly in touch with my pupils, male and female, because to direct the work of my young people, one must be always close to them. I have the interest of the Academy at heart."[2]

No talent or intelligence can be too exalted for teaching. Einstein is one of many bright examples. He was not too busy even to help a high school student with a problem in mathematics. As William Lyon Phelps so well said: "Teaching is an art—an art so great and so difficult to master that a man or a woman can spend a long life at it, without realizing much more than his limitations and mistakes and his distance from the ideal."

Borodin did not think of financial reward and fame when he dedicated himself to teaching. He found the reward, however, that comes to each teacher, as expressed by Henry Van Dyke: "He keeps watch along the borders of darkness, and attacks the trenches of ignorance and folly. Patient in his daily duty, he strives to conquer the evil powers which are the enemies of youth. He awakens sleeping spirits. He quickens the indolent, encourages the eager, and steadies the unstable. He communicates his own joy in learning and shares with the boys and girls the best treasures of his mind. He lights many candles which, in later years, will shine back to cheer him. This is his reward."

[2] Norman, Gertrude, and Shrifte, Miriam L., eds. *Letters of Composers: An Anthology*, New York: Alfred A. Knopf, 1946.

A Desk for Billie, the National Education Association's Centennial Film, tells the true story of a migrant child, now a successful editor and writer, who found her first opportunities in American schools. It is the first full feature-length film produced by NEA. In black and white $110, color $325 (order from NEA, 1201 Sixteenth St., N. W., Washington 6, D. C.). Prints may be borrowed from many State Education Associations.

TRENDS AND ISSUES IN

Junior High School Level Science

By DONALD W. STOTLER*

Supervisor of Science, Portland, Oregon, Public Schools

A DISCUSSION OF TRENDS and issues in science at the junior high school level must face three questions: What needs to be done? What is being done? What could be done?

WHAT NEEDS TO BE DONE?

Somehow the science demands of the future must be met. The junior high school can and must carry a proportionate share of the responsibility. It is doubtful if it has done so in the past or is doing so now. Science teachers must produce the numbers, kinds, and quality of scientists which the future will demand. At the junior high school level, similar types of experiences are apparently needed by both future scientists and non-scientists. Four needs are outstanding.

1. Increased Initiative. A study was conducted during World War II as to which soldiers were most adaptable and showed the most initiative. One factor emerged most consistently. The farm boy tended to show the most initiative and to be the most adaptable. Does this mean that farm life comes nearest to being what we call the experience curriculum? The farmer must "learn by doing" as each problem arises. In fact, a farmer would probably become bankrupt if his day were reorganized by experts into set periods devoted to learning in a specific area; that is, to mathematical calculations during one period, written communication another, scientific applications another, ad infinitum. It is doubtful if even his subject matter knowledge would increase; almost certainly his initiative would decrease.

Prior to 1900 the school was compartmentalized and dictatorial. Most people attended for only a few years. The school was more than offset by the experience curriculum at home in daily frontier and farm life. Since 1900 we have retained more and more students for longer periods of time in the schools while they have decreasingly had the experience curriculum offered by rural life. If we are going to continue our American initiative we must replace compartmentalized and teacher-dominated classrooms. We must move the frontier and the farm into the classroom and give students a 12-year sequence based on an experience curriculum, where the student is the initiator and the teacher a stimulant and a guide. Students at the junior high school level must be permitted to initiate many of their own educational experiences if initiative is important.

2. Increased Interest. Almost the entire curriculum of the kindergarten is based on the interests and questions of the students. As students progress through the school, however, studies show that the students ask fewer questions and the teachers more, until in high school by far the greater share of questions are asked by the teacher. This is not done by the teacher to deliberately ignore the interests of students, but rather to keep the students within the definite compartment or subject area which the teacher was employed to teach. For the problems of students do not respect the logical boundaries set out by the experts.

It is interesting to note that the small child is very similar to the scientist in two most important respects. Both have uninhibited curiosities and both are uninhibited in their ability to initiate. The scientist might almost be considered a person who has run the gantlet of the typical curriculum and managed to retain his childish curiosity and initiative. The junior high school level is a crucial stage in deciding how many will run the gantlet successfully. If interest in science is to be retained, the student's present interests must be an important part of the curriculum fabric and the teacher's part must be woven so as constantly to increase the student's span of interest.

3. Increased Scientific Thinking. Even the methods used by scientists are not completely different from the thinking of the child, for "scientific method" is but the efficient use of ordinary thought processes. Studies show that a small child approaches problems in the same manner as adults.

* A major talk given at the NSTA Regional Conference, December 28, 1954, Berkeley, California.

The difference is one of *degree* of knowledge and skill in thinking rather than a difference in *kind* of thinking. Just as the problem-solving of the child, the layman, and the scientist use the same approach, but differ in skill, so is there a close relationship between scientific thinking and democratic process. Both seek to clarify the true nature of a problem when it arises; both involve gathering and evaluating data about the problem; both involve seeking out the possible answers; both involve experimentation and the comparison of the results with what is already known. In democracy the process involves large groups, whereas in science the process may be an individual affair. However, even in science there is a trend toward cooperative problem solving in the laboratory as illustrated by science teams developed in some industrial research laboratories. The West Coast conferences conducted by NSTA in 1954 and 1955 are unique, research-team efforts of science teachers.

4. Increased Interrelationship of Content. When science embarks upon a problem such as how a car or a cat operates, it proceeds by dissection—by dividing or compartmentalizing the subject. This narrows the context of each experiment, permitting more people to operate on the problem without duplication. It also tends to increase the accuracy of each experiment. Slowly the time comes, however, when the carefully dissected and individually studied parts of the subject, whether a cat or a car, must be put back together and considered as they influence each other in the function as a whole. This requires the fusion of knowledge into larger and larger contexts.

When science first arose on this earth it set out to understand the whole universe. As with a cat or a car, scientists began by dissecting the universe into logical subjects or compartments—geology, geography, chemistry, and others. During this pre-atomic era it was natural that the schools should also be compartmentalized into the same areas. With the advent of the atomic era, science came of age. Inevitably the need arose to begin to put the universe back together. The universe as a whole became more closely related by the theory of relativity and other ideas. The compartments began slowly to fuse into larger and larger contexts. Naturally, fused subject matter also began to be demanded of the school. It is increasingly difficult to justify separate studies of isolated science topics such as heat, light, and sound, or even to justify science as a separate course at the elementary and junior high school levels.

All four of the above mentioned needs are harmonized in the problem-solving approach as needed for an experience curriculum. The problem-solving approach uses *scientific* and *democratic methods;* demands *fused subject matter;* begins with the *child's curiosity;* and requires time blocks long enough to permit the *child to be the initiator.*

WHAT IS BEING DONE?

Although the junior high school apparently came into existence primarily out of economic considerations, plus concern about retaining children in school longer, the justification most widely proclaimed for this new school was its new possibilities for educating students. Theoretically this school could provide more self-government, more interest groups or clubs, more personalized treatment, better vocational orientation, and besides a well-rounded homeroom or "core" experience, a variety of brief exploratory experiences in areas that could be expanded in senior high school.

One of the most enthusiastic followers of the junior high school movement was a supervisor from the Portland Public Schools—this school system has as yet no junior high school. Two years ago this supervisor accepted a position with Columbia University's Citizenship Education Project. It entailed much visitation of West Coast schools. He said that the greatest educational disappointment of his career was the typical junior high schools he visited. They were small high schools with little or no homeroom experiences offered, in the great desire to offer more and more separate content subjects taught by specialists. Science was taught as a separate subject at all three grade levels. Not content to have special subjects, there was a decided predisposition to separate these subjects into homogeneous grouping on a basis of IQ scores. This pattern apparently is typical over the nation. Furthermore, this trend in the junior high school is being imitated generally by the last two grades in the eight-year elementary schools, which is another development to study.

WHAT COULD BE DONE?

The issue we face is not one of praising or rejecting the junior high school as an educational institution in comparison with the eight-year elementary and four-year high school sequence. Either type of school can do very little educationally that cannot be done as well in the other—whether the trend is toward science in the homeroom or toward separate science.

The issue is whether science shall be integrated into homeroom experiences, or taught as a separate

subject, or both. From the point of view of educational philosophy, the issue is not as divergent as it appears on the surface. Most junior high school teachers and administrators would agree that ideally science at this level should be in the homeroom if the homeroom teacher would do, or could be led to do, a good job of science teaching. They plead that it calls for a science expert, and homeroom teachers are not interested in being brought to this level or haven't the time and energy to do so in terms of the pressures brought upon them to be experts in other areas also. They point out that students at this level need to contact many people, constant contact with but one teacher does not meet the needs. Also, the so-called gifted science student is apt to "wither-on-the-vine."

Actually, then, the basic issue at the junior high level is, *Can science be taught adequately in the homeroom?* Before giving a negative answer to this question let us consider several ideas and techniques for gaining a sound science program based upon homeroom experiences. (In school systems where the ninth grade is part of the high school, the ninth-grade science might well be retained separately until a successful seventh- and eighth-grade science is established.)

HOW TO DO IT

A. It is unlikely that junior high school science will get much duller if all separate science classes are eliminated—in fact, this cancels one of the main excuses for not teaching science in the homeroom.

B. Administrators and supervisors can do much by dealing with teachers as they would like to have teachers deal with their students. If teachers are to reassure students and make them feel secure enough to be led into experimentation and increased learning, it must be equally applicable to teachers. For example, if the teacher insists she doesn't teach science in the homeroom, it can be pointed out that she actually does, although it may not be labelled science. This approach will tend to put the teacher in a frame of mind to feel more secure with where she is educationally and hence more willing to become experimental with science in the classroom.

C. Rather than indicating that science is an additional subject in the homeroom, teachers can be encouraged to promote a "let's find out" attitude in all homeroom activities. In this way they can begin by merely extracting more out of whatever the homeroom happens to be doing. All things are based upon such science phenomena as gases, liquids, solids, radiation, vibrations, etc. For example, painting a mural involves color (What causes it and how is it brought about?) and paints involve liquids and solids (What causes these states and how are they related to gases?); music involves sound (Can we find a basic science principle that would explain how low and high notes are created by all instruments—including the voice box in our throats?).

D. One of the greatest aids to the homeroom science program, in my experience, is to discard all basic science texts and develop a pool of science books at all reading levels and on all subjects. A limit can be set (in terms of available money) on the number that any teacher can have at a given time (although rotation of books should be encouraged)—but no limit should be set on the kinds of books or reading levels the teacher chooses. The books will then come to be used as reading books as well as for science content. They are also especially useful for both the gifted and the retarded students. In addition, teachers become interested in reading these varied books and this offers background in science for them.

E. In some cases, teachers capable of doing an excellent job of homeroom teaching can be given released time to help improve the homerooms of other teachers.

F. A centrally located workshop area may be set up, usually as a part of an instructional materials center, where teachers may exhibit samples of their homeroom work as a suggestion for other teachers. Such an area should contain tools to enable teachers to experiment with classroom ideas under supervision.

G. In-service classes should be set up where teachers are taught with the same methods which administrators would like to see teachers use in the homeroom.

IT CAN BE DONE

H. Resource units suggesting a problem-solving approach and many science activities related to the total curriculum should be made available for new teachers or teachers who are just embarking on the unit teaching method. However, teachers should not consider these units as final in form or as required teaching. Teachers should be encouraged to build their own units with their own students, but with one eye to the general sequence laid down by the school board.

I. Science kits are rather easily prepared by selecting several books from the science booklist on a particular subject, such as weather, and at a

general grade level. The books can then be examined to see what materials are needed for the experiences. The books and materials are then placed in a box. These kits can be made available like films on a loan basis; also as with films, the grade level at which each is used should be largely up to teacher judgment.

J. Each year there should be definite curriculum projects laid out as new steps toward an experience curriculum. Many devices can be suggested—science fairs, tree-planting projects, community resource surveys, etc. The use of resource people in the homeroom and trips into the community help offset the charge that students see only the teacher in this type of educational design.

In my observations of both government and education, one general principle stands out—the obvious is seldom true. Democracy is the least obvious form of government and the experience curriculum is the least obvious form of education. I'm proud that our country's fathers plunged into the least obvious form of government, while others clung to more obvious governmental structures. I believe our children will be prouder of us if we move resolutely towards the form of education we generally agree would be preferable.

THRILLING NEW ADVANCES IN VISUAL AIDS

By ALLAN B. BURDICK

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WE have come a long way in visual aid technology. And the future looks better than even the most visual of us could envisage.

It is not difficult to recall the time when biology was taught with little more than a frog or a dogfish and a few bean sprouts. Students were given the unsavory chore of dissecting the fetid things and drawing pictures of what they found.

This sort of teaching was never very satisfactory because of three basic shortcomings inherent in the technique:

1. Tissues and organs are invariably out of place, making it difficult to teach the student where the part should be.
2. Students consistently evince interest in unimportant details, thereby distracting themselves, the instructor, and frequently, the whole class.
3. Real plants and animals inspire the most bizarre questions—questions to which the answer is not known and which frequently remain to bother the student even after he has completed the course. He gets the quite unsatisfactory feeling of knowing less when he is through than when he began.

These shortcomings were early recognized but their significance has not yet fully penetrated the ranks of biologists. We find among the old-timers a certain reluctance to abandon a method that has been influential in producing outstanding scientists. (Who can tell how much more outstanding these scientists could have been had they been introduced to biology via the visual aid route?)

Today visual aids enable us to survey the entire animal kingdom in two weeks with brightly colored charts and interesting plastic blocks. We can do as well with the plant kingdom and never need experience the vicissitudes of handling living plants. When it comes to anatomy, either plant or animal, we can study a whole variety of forms with disjoining plastic models and still not take as much time as a single form would require with the old "needle and cadaver" technique.

Visual aids lead to more satisfying results. When students are able to go back to a chart or model and correctly name the parts, and do this for a whole array of organisms and anatomical systems, it gives us the feeling of new power, new effectiveness in teaching. Our gratification is like that of an army general as he surveys his well-disciplined battalion on maneuvers, ". . . how well they remember what I have shown them."

We can look to the future and see even greater speed and more effectiveness in teaching with visual aids. Our immediate horizon shows such advances as colored charts embossed with electronic circuits to make a life cycle or a nervous system really come-to-life; lachrymating-plastic eyeballs, scented sponge rubber floral organs, and lactating mammary glands for lifelike effectiveness; and (this is where the "audio" of "audio-visual aids" comes in) even palpably vocal larynges. Through the miracle of the motion picture, we will soon be able to present fabulous field trips right in the classroom. Gone will be the necessity of time-consuming nature hikes and bird trips. We will be able to see it all on film.

With these teaching tools of the future at our disposal, biology will be as entertaining as it is informative. We will present far more material in a shorter period of time and attract many more viewers to the field. In addition, we will be able to compete effectively in attracting students with the gadgeteers of physics and chemistry. Our shows will be as profound and startling as theirs are.

Of course, there is still a lot of silly talk about visual aids, particularly from people who are, pedagogically, stuck-in-the-mud. They say that models and mock-ups are too expensive, that students delight in dismembering them, and that even though this innate inquisitiveness be diligently disciplined (as it must be, if we are to get our teaching done), the visual aid still takes a beating.

This objection is patently absurd. Visual aids are ***not intended*** to be placed in the hands of students, but rather, should be exhibited before them and demonstrated by a competent person, presumably the instructor. (I have seen incompetent instructors mishandle precious visual aids to the point where I think we need a course in the handling of visual aids for future instructors.)

Recalcitrant pedants have been heard to mutter that with the visual aid method, the student is reduced to a role of mere spectator, that he no longer feels like a participant in biology but rather, in his subdued state of ennui, he quietly goes along as an observer. He is not asked to think and decide, simply to look, listen, and remember. They usually add, philosophically, "After all, there is no substitute for the real thing."

Well, this is sheer nonsense. We can't all be participants, anyhow. We are a nation of spectators and the sooner a student realizes this, the better. As far as this "subdued state of ennui" is concerned, I find it quite delightful in my classes. Students are far easier to control and also far easier to examine. Visual aids fairly exude test questions and in case of disputed facts, there is always a model or chart to fall back on. The contentious assertion that there is no substitute for living material in biology is certainly not in accord with the facts. Any visual aid catalogue will serve to bring the uninformed up-to-date on this point.

One also hears the unwarranted derision that we cover too much material when we race through biology with visual aids, that our courses become watered-down survey courses and that students do not have the time to develop an interest in the really fascinating details of biology.

All that may be said here is that we have a job to do, and it is a big one. Biology is expanding every day and we are expected to keep up. If a student wants to pick away at a toadstool, that's fine, but he'll have to do it after class.

One final point must be made. It has to do with an iniquitous effort to sabotage the whole visual aid movement. The plot, in essence, is to use the visual aid merely as a roadmap—to guide the student on an actual journey in biology, not to be a vicarious substitute for the journey. This roadmap notion may be all right in some instances but it clearly does not utilize the full potentiality of visual aids and it in no way obviates the three above mentioned shortcomings of teaching with living material. I am sure we will not stand idly by and see the visual aid reduced to the subject role of roadmap for the outmoded living organism.

POLIO EDUCATION:

A LIVE STUDY FOR THE CLASSROOM

By JANET M. LOWE*

Assistant Professor of Biological Science, Central Washington College of Education, Ellensburg

SELDOM DOES A SCIENCE CLASS have the opportunity to apply scientific methods to an experiment using human subjects. The polio vaccination experiment provides just such an opportunity. Why not take advantage of it?

I have used the following organization of ideas together with the wealth of available resource materials in two classes of biological science at the college freshman level. It has proved both valuable and inspirational as a way of learning for these young people. Similar types of experiences can be developed for all age groups. It is hoped that the following discussion will be of assistance to teachers who would like to capitalize on this opportunity.

The biggest experiment in the medical history of the United States has taken place during the past year, and the subjects who received polio vaccine have been, and are now, in our school classrooms. The size of this experimental group is tremendous; over one million children took part in the trial vaccinations. These children can be fascinated with an understanding of their part in the medical detective story written by Dr. Jonas Salk.

A valid test of any idea or hypothesis employs the scientific method, embodying an intellectually sound approach to cause-and-effect relationships. Such cause-and-effect relationships between microorganisms and disease were firmly established by Robert Koch and Louis Pasteur during the 19th century. The problems which existed then were no more awesome than the problems of medical and industrial disease control today. Koch's postulates are the basic criteria established by Robert Koch in about 1880 as necessary proof for the casual relationship between microorganisms and disease. Years of research were required to ascertain the relationship between the suspected virus and poliomyelitis. According to Koch, to establish a cause-and-effect relationship, the organism must be found associated with all cases of the disease and in logical relationship to the disease. The organism must be capable of isolation in pure culture from diseased subjects, and this pure culture must in turn be able to reproduce the disease in susceptible animals or in man. Further, the same organisms must be isolated in pure culture from the inoculated susceptible animal or man. The background of knowledge finally obtained provided the basis for the hypothesis or tentative supposition embodied in the Salk vaccine experiment.

This mechanical, visual display enables students to clarify in their minds the pathways of a nerve impulse and to see the relationship between injury to nervous tissue in various areas and the disease manifestations.

During the first ten years of its existence, the National Foundation For Infantile Paralysis supported basic research related to polio. From this accumulated mass of data came knowledge leading to the formulation of a hypothesis regarding possible immunization to polio. Infantile paralysis began to lose its shroud of mystery; research revealed points of similarity to other infectious diseases. It was established that the polio virus

* The author has collaborated with the Washington State Department of Public Instruction in the formulation of a resource unit for teachers in this subject area. The unit is entitled "Medicine in the Making" and is free to those requesting copies.

Richard M. Nelson, science teacher of Kalispell, Montana, was the fifth "McCall's Teacher of the Year" to be chosen by that magazine. He is a sustaining member of NSTA. Mr. Nelson was brought to Washington early in June and given a round of honors including meetings with President Eisenhower and Vice President Nixon. Two of his students accompanied Mr. Nelson. Following their tour of Washington, the party went on to New York City where they were joined by two other students who had driven through in Mr. Nelson's car. The five then gradually drove, camped, and "field tripped" their way back to Montana in time for the opening of schools this fall. Congratulations to Mr. Nelson for the credit he has brought to himself, the teaching profession, and to science teaching in particular.

LACY'S STUDIO
WHITEFISH, MONTANA

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does and will respond to application of the basic principles of immunology.

The end of the "monkey age" in polio research came in 1949 when Dr. John F. Enders of Harvard succeeded in growing polio virus in test-tube cultures of non-nervous tissues. The test-tube substitution for costly and difficult-to-maintain monkeys not only accelerated research, but also eliminated the threat of allergic reactions in humans from nervous tissue vaccines obtained from infected spinal cords and brains of monkeys. In addition, the test-tube culture media could produce vaccine inexpensively and without quantitative limitation.

Virologists and physicians had long puzzled over the occasional second attacks of polio in patients who had recovered from previous infection. Such attacks were very difficult to explain in view of the fact that monkeys resist a second deliberate exposure following recovery from experimental infection. Over one million dollars and three years of intensive pinpointing research exposed three major polio virus types. Although all three types produced similar clinical symptoms, each was found to be immunologically type-specific. That is to say, infection by any one will not stimulate antibodies capable of neutralizing either of the other two. It follows that, to be effective, any preventive agent such as a vaccine would have to protect against all three viruses.

Prior to 1952, scientists working with the polio virus postulated that the virus usually entered the body through the mouth and intestinal tract and from there traveled along nerve fibers to nerve cells in the central nervous system. It was believed at that time that the virus completely by-passed the blood stream. If this were the case, it seemed unlikely that a vaccine which engendered the production of antibodies circulating in the blood would have any protective value.

Early in 1952, however, a new investigation by Dr. Dorothy Horstman of Yale and Dr. David Bodian of Johns Hopkins culminated in proof that the polio virus does circulate in the blood during the early stages of the disease. Presumably, then, there was a time and place in the body for antibody destruction of the virus before it reached the central nervous system and the motor nerve cells. It was also demonstrated that small amounts of specific polio antibodies, administered to monkeys shortly before infection, would prevent blood stream infection with the virus (viremia) and the subsequent crippling paralysis. An experimental vaccine had been produced which would stimulate sufficient polio antibody formation in monkeys and chimpanzees to protect them against subsequent exposure. The question then was: Would a similar response to vaccine develop in the human body?

Dr. Jonas Salk published results of vaccine studies on 161 children in the spring of 1953. Blood tests indicated a relatively high antibody production in these children and there were no harmful effects from receiving the vaccine. It had now become possible for the first time to set up a field problem for the evaluation of a vaccine and, indeed, to test the hypothesis that a vaccine will immunize against paralytic polio. Relative to control and prevention of infantile paralysis, will the Salk vaccine develop sufficient immunity to the disease to prevent the crippling effects of polio paralysis? Will the immunity be permanent?

The plan to test the hypothesis embodied large-scale immunizations of school children throughout the United States. In order to provide a scientific cross-section of the country as a whole, selection of the sample population of children was based upon a history of polio incidence during the last five years, on adequacy of available health services for administration of the program, on population density in each area, and on pertinent social, economic, and geographical factors. Our first-, second-, and third-grade children who enacted this great experiment participated in accordance with two plans, each of which employed a large control group for valid, conclusive observation. One plan

(Please continue on page 259.)

1957 Science Achievement Awards FOR STUDENTS

Announcement Poster and Information

WHY **1.** This program of Science Achievement Awards for Students is designed to encourage individual students to plan, develop, complete, and report projects in science and mathematics.

WHAT **2.** Projects may involve experimental studies, library reports, or other activities similar to those carried on by practicing scientists.

3. In general, a science project is thought to be a study of something—what it is, how it happened, or how it may be made to happen. Experimenting, collecting and classifying things, designing and building equipment, and preparing and illustrating reports are appropriate activities for the development of projects.

WHO **4.** All students in any kind of science or mathematics class in grades 7 through 12 may enter. Students in public, private, and parochial schools in the United States and its territories and Canada are eligible.

5. Seventh and eighth grade students compete with other 7th and 8th grade students only; likewise for grades 9 and 10 and for grades 11 and 12. There are separate sets of awards for each grade division in each of eight geographic regions (see map). In addition, projects at any grade level which deal with *metals and metallurgy* will be considered for twenty *special national awards.*

HOW **6.** A completed entry consists of (1) a clear, brief report of a project (photographs and other illustrative material may be attached), (2) a personal data form, and (3) a completed 3-part entry card. Personal data forms and entry cards may be obtained from The Future Scientists of America Foundation, The National Science Teachers Association, 1201 Sixteenth St., N.W., Washington 6, D.C. Use the attached coupon.

7. Entries must be mailed to regional chairmen (names and addresses will be sent with entry materials requested). Entries may be mailed at any time, but must be postmarked *not later than March 15, 1957.*

8. In general, projects are judged on the basis of how much the student learned about his topic as revealed by his report. Judging is simplified if the report includes (1) a clear statement of the topic or problem, (2) a complete report of the data and how they were obtained, (3) a statement of findings or conclusions reached, (4) the student's interpretation of these conclusions, and (5) a brief summary of how the project was valuable to the student.

SPONSORS **9.** The Science Achievement Awards for Students are made possible through annual grants from the American Society for Metals.

10. The program of Science Achievement Awards for Students is conducted by the Future Scientists of America Foundation of the National Science Teachers Association, a department of the National Education Association.

140 Awards Totalling

$10,000

For projects in any field of science or mathematics:

40 regional awards in grades 7 and 8
$25 Savings Bonds

40 regional awards in grades 9 and 10
$50 Savings Bonds

40 regional awards in grades 11 and 12
$75 Savings Bonds

Projects dealing with metals and metallurgy will also be considered for:

20 SPECIAL NATIONAL AWARDS
$100 Savings Bonds

All projects at any grade level dealing with metals and metallurgy will be considered for these awards.

NOW . . . entries must be mailed to regional chair- ot later than March 15, 1957. Ask your teacher to or entry forms. Use the attached coupon.

N SOCIETY FOR METALS

Use this coupon to order recent NSTA publications.

National Science Teachers Association
1201 16th Street, N. W., Washington 6, D. C.

Indicate in spaces at left the numbers of each title desired. Enclose remittance, or request to be billed. *Payment must accompany all orders for $1.00 or less.* Prepaid orders sent postpaid.

The first two titles are 50¢ each for single copies; two or more copies mailed to the same address, 25¢ each.

..........IF YOU WANT TO DO A SCIENCE PROJECT. 1955. Helps students understand the way practicing scientists work. Suggests how students can adapt similar methods in completing projects.

..........ENCOURAGING FUTURE SCIENTISTS: STUDENT PROJECTS. 1954. Ideas for projects, how they should be reported, and general information.

..........ENCOURAGING FUTURE SCIENTISTS: MATERIALS AND SERVICES AVAILABLE IN 1956-57. Listing of career guidance pamphlets, contest and award programs, films, special summer programs for students and teachers, and similar activities. *Free.*

..........SCHOOL FACILITIES FOR SCIENCE INSTRUCTION. 1954. $5.00 for NSTA members; $5.50 for non-members. A guide for planning laboratories, classrooms, greenhouses, audio-visual aids, and other science teaching facilities.

..........List of other NSTA publications.

Send to..
(PLEASE TYPE OR PRINT)

Address..

....

Amount Enclosed.................... Please bill....................

CLIP AND MAIL TO:

Future Scientists of America Foundation
The National Science Teachers Association
1201 16th St., N. W., Washington 6, D. C.

Please send me (circle or write in) 3 10 20 30 .... sets of student entry materials for the 1957 program of Science Achievement Awards for Students. I hope to have this many students enter. Please send me .... additional copies of this poster.

Teacher's Name..
(PLEASE TYPE OR PRINT)

School Address..

....

....

This contest has been placed on the approved list of contests and activities for 1956-57 by the National Contest and Activities Committee of the National Association of Secondary-School Principals.

THERE ARE EQUAL AWARDS FOR EACH GRADE LEVEL IN EACH OF THESE EIGHT REGIONS

PLEASE POST ON STUDENT BULLETIN BOARD

SCIENCE EDUCATION IN THE CENTENNIAL OF THE ORGANIZED TEACHING PROFESSION

THE NATIONAL EDUCATION ASSOCIATION, "big umbrella" organization for some 30 affiliates like the National Science Teachers Association, which have their own specialized interests and operate rather independently, will observe its Centennial during the calendar year of 1957. Since the occasion represents the 100th birthday of the organized teaching profession in America, and since NSTA is actually a part of NEA, headquartering in its new building and speaking for science teachers as part of the total teaching profession, it is appropriate that NSTA and science teachers everywhere join in the observance.

Certainly the NEA in 1957 will have passed the point where any might regard it as an ephemeral idea. For a century it has been a unifying symbol for teachers and a rallying force for all those, both inside and outside the profession, who believe in education. It is heartening that a unifying organization which depends upon people of such diverse interests — and sometimes extremely divergent views—can survive in America and be in such apparent good health after a century. It suggests that the teaching profession—and indeed America —can be strong with a *unity* that comprehends *diversity*—*unity* and *diversity* being two mutually opposed values we think worth preserving.

NSTA expects to use the occasion to celebrate that unity—to join all others in calling attention to the role of the total teaching profession in building the schools and the nation. Also, NSTA is not just exactly an upstart organization itself; it got its start back in 1895 as the NEA Department of Natural Science, merging with the American Science Teachers Association (of the American Association for the Advancement of Science) to become NSTA in 1944.

Perhaps it is significant that the 100th year of NEA promises to be an epoch-making one for science. It is the *Geophysical Year*. July 1, 1957, the day NEA will be opening business sessions at its Centennial Convention in Philadelphia, is the date set for launching the first man-made satellite. 1957 should be a good year to promote a wider appreciation of the sciences, the part they have had in the century just past, and their promise for the centuries to come.

NEA's plan for the observance comprehends all groups—including NSTA, represented through some of its staff on committees. It has set up a Commission of 21 outstanding leaders from both outside and inside the profession. This Commission has established a theme and objectives for the program, and the Centennial Office has been set up as a clearinghouse and coordinating center. The Commission has approved some 30 different projects which have been assigned to committees.

The theme for the program is "An Educated People Moves Freedom Forward," and stated objectives are:

1. To consider the decisive role of education in a changing world.
2. To stimulate action to provide adequate education for the increasing millions of children.
3. To strengthen the teaching profession in its service to people of all ages.

TIMETABLE OF THE NEA CENTENNIAL

1956	
July 1	Premiere of Centennial Film: "A Desk for Billie," ready for distribution in fall and 1957.
September	Centennial Edition NEA HANDBOOK published.
1957	
January	NEA Centennial Music published. Manual of County and State Fair Exhibits for Centennial published.
March	NEA HISTORY published.
April	American Library Association BULLETIN, Special School Issue.
April 14	NEA Centennial Birthday Party.
May	NEA — State Journals feature 1957 convention.
June 30 —July 5	Centennial Convention in Philadelphia. NEA Commemorative Stamp issued. NEA Tours focus on Philadelphia. FTA ceremonies at Athenaeum, site of NEA organization in 1857. NEA Centennial Festival.
August	Centennial VOLUME OF PROCEEDINGS.
November 10-16	American Education Week.

Classroom Ideas

Physics

An Apparatus for Introducing the Principle of Polarized Light

By ROBERT H. LONG, Green Mountain Junior College, Poultney, Vermont

The third-dimension problem that comes up in teaching the principles of polarization of light and optical activity of certain compounds can be readily solved by the simple apparatus shown here. It is easy to make and requires almost no preparation for demonstrating.

The functioning parts of the apparatus consist of two large disks with slots to represent the gratings, and several wave-forms shaped from baling wire. One of the disks (B) is placed loose in the groove, so that it can be rotated. The other disk (D) is fastened in its groove so that it does not turn. Block C is mounted on a dowel which is fitted in the base so that it can be easily removed. Small holes are drilled in the ends of C so the wave forms can be readily inserted or removed.

By removing C, it is possible to show students how light vibrating in one plane can pass through D and continue through B, if the latter is in correct position, and also to show how B will obstruct E if its openings are not parallel with those of D.

By using the apparatus as shown in the drawing, and with C representing the tube of a polarimeter (containing the optically active compound), it is a simple job to show how some substances rotate a beam of polarized light. By showing how disk B is rotated, from a position where the openings are parallel with those of D to a place where the openings are parallel to the plane of wave-form A, students can see how the degrees of rotation are measured.

The apparatus is useful to explain the ideas either when studied as text material or before students actually manipulate a polarimeter.

Chemistry

Laboratory Savings

By DAVID D. PORTER, Central Catholic High School, Portland, Oregon

In these days of high costs, every dollar saved in education is important. Recently I realized that a number of our standard laboratory experiments are rather wasteful. For example, our lab manual tells the students to "cover the bottom" of their hydrogen generators with zinc. This is interpreted very differently by different students. Some use 3 or 4 pieces, while others use a ½-inch layer. When the usual 4 or 5 bottles have been collected and all the tests have been completed, this zinc is almost unused. It ordinarily ends up in the waste can.

Now, of course, the instructor should warn his students against this waste, but we don't always get it done. Recently, I tried a full day's lab activity involving hydrogen with no word concerning economy, but provided a container for the washed but unused zinc to be deposited in. I was amazed to obtain 1160 g. of metal. This figures out to be about 20 g. per pair of lab partners. At a catalogue price of 56¢ per lb., we had saved about $1.50 during this one lab day. Following the lab manual we use, hydrogen is generated at least twice each year. Multiplying this saving by the 25,000 U. S. high schools, I conclude that several

thousand dollars each year is thrown out as waste zinc. Also, this metal may be used two, three, or four times if the pieces are fairly large.

This principle of saving might be applied in many lab activities other than the one I have mentioned.

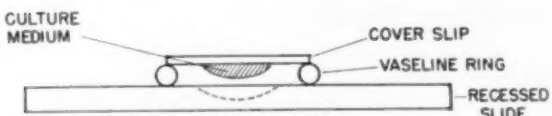
Biology

Culture Slides by the Week

By RICHARD F. THAW,
Corvallis High School, Oregon

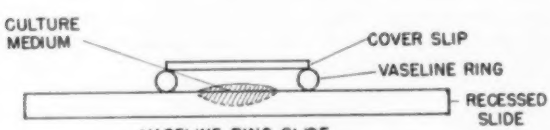
Oftentimes in the laboratory study of protozoa, it is desirable to use a given slide culture for an entire day or for as long as a week.

Several methods or techniques of sustaining live material on slides have been noted in the literature. Of the various methods described, we have found three, that with slight modifications, are particularly successful.



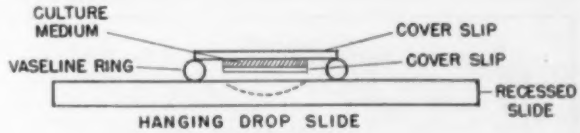
HANGING DROP SLIDE

Used with good results are the "hanging drop" and the "vaseline ring" slides. To get best results, recessed slides purchased from Turtox were employed. The hanging drop slide for use under low power of the microscope can be prepared by placing a ring of *slightly warmed* vaseline around the recessed area in the center of the glass slide. A drop of culture material is then put on a cover slip. With careful manipulation, the cover slip can be turned upside down and then set in the vaseline ring. With practice, this tool is easily readied in a few minutes time. A point to mention here is that this slide is especially useful in growth curve studies, which in each case begin with an isolated protozoan. It will be noted that the culture should contain food if reproduction is expected.



VASELINE RING SLIDE

For specimen study under high power magnification, the same procedure is followed, but after having placed the culture medium on the cover slip, another cover slip of smaller size is placed on the specimen drop. The animals to be observed will then be between two cover slips. The cover slips are turned upside down and the larger cover slip is then cemented by its margins to the vaseline ring.



HANGING DROP SLIDE
FOR HIGH POWER

To keep living material on a slide for as long as a week, it is desirable to use the recessed portion of the glass slide as the container for the culture and the added food supply. After placing the cover slip on the vaseline ring, the culture is safe from drying out and is ready for several days observation.

The writer has used the tools described above in high school classes for observational studies of various types of micro-invertebrates. The success that followed more than compensated for the time spent in the preparation of these tools.

5TH NATIONAL CONVENTION OF NSTA

It was last March 17 at the close of the Washington convention that the general planning committee for the 5th national convention of NSTA held its first meeting. A second meeting was held late in May. Good progress has been made toward a convention design, and it is hoped that science teachers all over the country are beginning to make their plans to attend.

First is the time and place of the convention. It will be held at the Hotel Cleveland, Cleveland, Ohio, during March 20-23, 1957.

The theme chosen for the convention is: *New Frontiers for Science Teachers.*

On the First Day . . .

. . . Wednesday, March 20, the topic of the day will be *Frontiers in National Security.* Beginning at 1:30 p.m., the topic will be treated in a major address under the approximate title of "Elements of National Security Related to Science Teaching." This address will be given by a figure of national renown. The address will be followed by a group of four discussion sessions set up around the topics of health, human resources, natural resources, and the industrial establishment.

After dinner, there will be another major address along the lines of "National Security and Science Teaching." This will be followed by a panel discussion, with panel members drawn from the afternoon discussion groups.

During the morning of Wednesday the 20th, the registration desk will be open, selected films will be shown, and various NSTA committees will meet.

On the Second Day . . .

. . . Thursday, March 21, the day's theme will be *Science and Social Frontiers.* Two addresses in the morning and one in the afternoon will develop the theme; the three titles, tentatively, are "The Impact of Science on Society," "Science and Human Values," and "Understanding Science."

Tours of industrial establishments and other science-related activities in the Cleveland area are planned for the afternoon. The traditional "This Is Your NSTA" and "Hospitality Night" will follow that evening.

On the Third Day . . .

. . . Friday, March 22, the program is being planned around the theme, *Frontiers in Scientific Research.* The morning session will feature a panel presentation by distinguished scientists of "New Scientific Ideas of Most Consequence to Science Education."

The afternoon will be devoted largely to discussion groups divided by teaching level (elementary, upper elementary, junior high, senior high, and teacher education) and by conference topic (National Security, Science and Social Frontiers, and Frontiers of Scientific Research).

The evening session will be given over to the traditional banquet, with a speaker of national reputation as its chief attraction.

On the Fourth Day . . .

. . . Saturday, March 23, the morning session will present two activities in exploration of the day's theme, *New Responsibilities for Science Teachers.* The first will be a general meeting addressed to the topic, "Modern Criteria for Selecting Subject Matter." The second will be a divided meeting with two panels on the topic, "Modern Criteria for Selecting Instructional Methods."

The afternoon sessions will feature the popular and now-traditional "Here's How I Do It" presentations, with special offerings for elementary science, general science, biology, chemistry, and physics.

Throughout the Convention . . .

. . . There will be a display of 60 or more commercial exhibits. This annual Exposition of Science Teaching Aids has become established as a highlight of NSTA conventions.

The General Planning Committee . . .

. . . responsible for the Cleveland convention is as follows. James G. Harlow, *chairman,* University of Chicago; Dorothy Alfke, *sub-chairman for elementary science,* Pennsylvania State University; Arthur O. Baker, *chairman of local committees,* Board of Education, Cleveland; Mrs. M. Gordon Brown, Atlanta, Georgia, Public Schools; Chester A. Lawson, Michigan State University; Mrs. Grace Maddux, *local chairman for elementary science,* Board of Education, Cleveland; Ellsworth S. Obourn, U. S. Office of Education; Herbert Reichard, Allentown, Pennsylvania, Senior High School; and Dorothy Tryon, Redford High School, Detroit, Michigan. John S. Richardson, President of NSTA, and Robert H. Carleton, Executive Secretary of NSTA, are *ex-officio* members.

The committee cordially and sincerely invites all members of NSTA to submit comments and suggestions relative to the program, and to speakers and participants. Send all such communications directly to the chairman; they will receive full and serious consideration.

CLEVELAND, OHIO
MARCH 20-23, 1957

NSTA Activities

New Board of Directors

As of 10:53 p.m. the night of July 1 in the Memorial Union building at Oregon State College, Corvallis, the 1956 business meeting of the NSTA Board of Directors came to a close. Simultaneously, the following assumed office as the official governing body of the Association for 1956-57. The years terms expire and fields of special interest are given in parentheses.

Executive Committee

President: John S. Richardson (1957, teacher education), The Ohio State University, Columbus

President-Elect: Glenn O. Blough (1957, teacher education, elementary science), University of Maryland, College Park

Retiring President: Robert Stollberg (1957, teacher education), San Francisco State College, California

Secretary: Gertrude W. Cavins (1957, teacher education, chemistry), San Jose State College, California

Treasurer: Richard H. Lape (1957, biology, department head), Amherst Central High School, Snyder, New York

Executive Secretary: Robert H. Carleton, NEA Educational Center, Washington, D. C.

Region I

Director: Fletcher Watson (1957, teacher education, astronomy), Harvard University, Cambridge, Massachusetts

Alternate: Dorothy Gifford (1957, chemistry, department head), Lincoln School, Providence, Rhode Island

Region II

Director: Herbert Reichard (1958, physics, department head), Allentown High School, Pennsylvania

Alternate: Dorothy Alfke (1958, teacher education, elementary science), Pennsylvania State University, University Park

Region III

Director: Robert Lagemann (1957, physics, department head), Vanderbilt University, Nashville, Tennessee

Alternate: Howard B. Owens (1957, biology, county system supervisor), Prince Georges County, Maryland

Region IV

Director: Ernest E. Snyder (1958, teacher education, biology), State Teachers College, Florence, Alabama

Alternate: John A. Manning (1958, physical science), Natchitoches High School, Louisiana

Region V

Director: Paul Klinge (1957, biology), Thomas Carr Howe High School, Indianapolis, Indiana

Alternate: Violet R. Strahler (1957, chemistry, department head), Stivers High School, Dayton, Ohio

Region VI

Director: Henry E. Goebel (1958, general science), Irving Junior High School, Lincoln, Nebraska

Alternate: Gertrude M. Olson (1958, biology), Great Falls High School, Montana

Region VII

Director: Herbert Smith (1957, educational research), University of Kansas, Lawrence

Alternate: Frederick B. Eiseman, Jr. (1957, chemistry, department head), John Burroughs School, Clayton, Missouri

Region VIII

Director: Edward M. Gurr (1958, chemistry), South Mountain High School, Phoenix, Arizona

Alternate: Robert A. Rice (1958, chemistry, department head), Berkeley High School, California

Along with good wishes to those now assuming office, our thanks and appreciation go to the following retiring members of the 1955-56 Board who have served the Association with devotion and untiring efforts: *Retiring President* Walter S. Lapp, Philadelphia, Pennsylvania; *Secretary* Dorothy Tryon, Detroit, Michigan; *Region II Directors* G. Marian Young, Baltimore, Maryland and Charles G. Gardner, Syracuse, New York; *Region IV Directors* Ruth Armstrong, Fort Smith, Arkansas and Otis W. Allen, Greenwood, Mississippi; *Region VI Directors* J. Donald Henderson, Grand Forks, North Dakota and Merton M. Hasse, Vermillion, South Dakota; and *Director-at-Large* Wayne Taylor, Austin, Texas.

Actions at Corvallis

Among the many actions taken by the Board of Directors during the Corvallis sessions, June 30-July 1, the following are noteworthy in setting goals and new program elements for 1956-57.

1. Approved budget of $200,000 of which about $45,000 is expected from about 10,000 members and subscribers. (The 1955-56 budget was $160,000 and membership on May 31 totaled 9018.)

2. Approved the appointment of a 15-member Commission on Education in the Basic Sciences. Expected to undertake major studies in curriculum, teacher education, and instructional procedures in science, CEBS will announce membership and operational plans later this fall.

3. Approved the appointment of a committee to plan and carry through to publication the preparation of a Yearbook on timely and significant aspects of

science teaching. Without committing the Association to a plan of annual yearbooks, the Board did point out that it is now ten years since the 46th Yearbook of the National Society for the Study of Education was published and that another major effort of this kind is in order.

4. Authorized a Committee on Legislation to study proposed and pending legislative measures, federal and state, that may affect science teaching, and to advise the NSTA Board of appropriate action. This committee will work closely with the NSTA Policy Committee.

5. Authorized or continued committees that will keep NSTA cooperating actively with such groups as the American Association of Physics Teachers, Oak Ridge Institute of Nuclear Studies, Division of Biology and Agriculture of the National Research Council, the National Association of Biology Teachers, and the American Chemical Society.

Southwest Regional Conference

A Southwest Regional Conference for Science Teachers has been organized for October 26-27 in Phoenix, Arizona. The Arizona Science Teachers Association (an NSTA affiliate) will direct the conference; NSTA, the Arizona Education Association, and the Arizona Academy of Science are co-sponsors. Theme of the conference is "The New Pressures on Science Teaching."

On Friday morning the conference will join with AEA to hear J. Lester Buford, retiring president of the NEA. That same evening the conference will again join AEA to hear an address by Carlos P. Romulo. Following a luncheon get-together, Friday afternoon will be devoted to group meetings of science and mathematics teachers. Saturday morning, the 27th, will likewise be given over to group discussions with emphasis on problems and techniques of teaching at elementary, secondary, and college levels. Many tours through industrial plants and educational laboratories will be available Saturday afternoon.

Edward M. Gurr is general chairman of the conference. Well-known NSTA'ers expected to take part include John S. Richardson, Gertrude Cavins, Robert Stollberg, and Robert Rice. It is planned to mail printed programs in advance of the conference to science teachers throughout the region, including Arizona, New Mexico, Colorado, Utah, Nevada, and California.

Business-Industry Section

NSTA's Business-Industry Section, composed of representatives of business and industrial organizations interested in supporting NSTA's aims, elected national officers for 1956-57 at the March 15th annual meeting in Washington, D. C.

Approved as a Section by NSTA's Board of Directors in December 1949, the B-I group serves as a communication link between industry and the teaching profession on problems of mutual concern. With more than 170 members, the B-I Section represents about 150 of the nation's major industries.

The following are the members of the B-I Section's Executive Committee and the Standing Committee Chairmen for the year from April 1956 through March 1957.

Executive Committee

Chairman: Robert C. Lusk, Automobile Manufacturers Association, Detroit, Michigan
Vice-Chairman: Leo Murphy, Crucible Steel Company of America, Pittsburgh, Pennsylvania
Secretary: Robert D. Stanton, General Electric Company, Schenectady, New York
Treasurer: Owen O. Hunsaker, United Air Lines, New York City
L. R. Bateman, United States Steel Corporation, Boston, Massachusetts
Elizabeth W. Robinson, National Association of Home Builders, Washington, D. C.

Standing Committee Chairmen

Chapters: Thelma T. Scrivens, Hill and Knowlton, Inc., New York City
Finance: Owen O. Hunsaker, United Air Lines, New York City
Membership: Inez M. De Ville, Baltimore & Ohio Railroad Company, Baltimore, Maryland
Newsletter: Alma Deane Fuller, American Forest Products Industries, Washington, D. C.
Nominating: Reginald G. Sloane, Standard Oil Company (New Jersey), New York City
Program: Gilbert P. O'Connell, General Motors Corporation, Detroit, Michigan
Research: Tom M. White, Chrysler Corporation, Detroit, Michigan
Textbooks: George R. Seidel, E. I. du Pont de Nemours & Company, Wilmington, Delaware

Woodburn Resigns: Batiste Marries

"Deep appreciation for your zealous and effective service to NSTA and FSAF and best wishes for your professional future" were sentiments very much in order as of August 10 when Dr. John H. Woodburn's resignation as Assistant Executive Secretary of NSTA became effective. His original agreement to "come in for a year and help get FSAF off the ground" lengthened into a three-year tour of duty. During this time FSAF has become firmly established as a major program in helping keep the pipeline of future scientists and engineers filled. Dr. Woodburn will continue to live in Silver Spring, Maryland (suburban Washington), but he has not yet announced his future professional plans.

On last June 9, Mary E. Batiste, NSTA Administrative Assistant, became the bride of Cameron Murchison of Washington, D. C. Mr. Murchison is connected with the National Security Agency. Mrs. Murchison will continue with NSTA.

1956 STAR *Awards for Science Teachers*

PURPOSES

This program of Science Teacher Achievement Recognition (STAR) Awards is designed to encourage the reporting and dissemination of outstanding science teaching ideas. It is intended to help raise the general level of science instruction, assist young people to understand that the key to our science problems is more and better research, and influence capable students to consider careers in science-related occupations.

It is also designed to help young people gain skill in scientific problem solving and develop more reflective and critical habits of thought.

SPONSORS

The STAR program is supported by a grant from the U. S. National Cancer Institute to the National Science Teachers Association. It is conducted by NSTA through a National Advisory Committee.

The National Cancer Institute made the grant because it recognizes the importance of the science teacher in developing a pool of young scientists from which may be recruited future leaders in research, science teaching, and other scientific professions.

KINDS OF ENTRIES

The following illustrate types of activities, reports of which are suitable for submission as entries in *STAR:*

- ► Teacher demonstrations
- ► Laboratory exercises
- ► Motivation devices
- ► Pupil projects
- ► Lesson plan outlines
- ► Use of community health resources

It is emphasized that participants in STAR are in no way restricted as to content areas.

JUDGING

Entries, which should be related to one or more of the purposes of *STAR*, will be judged on the basis of resourcefulness in terms of ingenuity and the most effective use of available facilities; creativeness; completeness in conception and presentation; accuracy; and utility for application in other teaching situations.

AWARDS

There will be: 10 $200 awards *or* 3-day, all-expense trips to Washington, D. C.; 50 medallions to individual winners; 50 plaques to schools represented by teacher winners. Also, many award-winning entries will be published in a brochure, in *The Science Teacher,* and in other journals.

STEPS

1. Fill in and mail coupon to receive helpful materials. 2. Classroom-test your idea(s). 3. Submit *two,* double-spaced, typewritten copies of your report. Photographs and other illustrative materials may be included as part of the report. 4. Entries must be postmarked not later than *December 21, 1956.* 5. Mail entries to: STAR Awards, National Science Teachers Association, 1201 Sixteenth St., N.W., Washington 6, D. C. 6. Awards will be given out and winning teachers honored at the 1957 NSTA National Convention in Cleveland, March 20-23.

Clip and mail to:

National Science Teachers Association
1201 Sixteenth Street, N. W.
Washington 6, D. C.

☐ **I plan to participate in the 1956 STAR Awards Program with an entry from**
☐ **general science** ☐ **biology** ☐ **chemistry**
☐ **physics** ☐ **other:...**

☐ **Send me the free packet of selected cancer information and educational materials.**

Name...

School...

School Address...

City and State..

1. **Pupil population of your school:**
   ☐ **under 300** ☐ **300-1000** ☐ **1000 or more**
2. **How many years have you been teaching science? .... years**
3. **Your total daily teaching load in science:**
   .... pupils .... classes
4. **By your own standards, how would you rate the science teaching facilities and resources of your school?**
   ☐ **meager** ☐ **adequate** ☐ **exceptional**

FSA Activities

Administrative Committee

The goals and action programs of NSTA's Future Scientists of America Foundation (now entering its 5th year) are designed and nurtured by an Administrative Committee appointed by the President and approved by the Board of Directors. Membership of the current Administrative Committee is as follows; the years terms expire are in parentheses. Henry H. Armsby (1957), U. S. Office of Education, Washington, D. C.; Philip G. Johnson (1957), *chairman,* Cornell University, Ithaca, New York; Katherine Hertzka (1958), Hoke Smith High School, Atlanta, Georgia; Thomas Osgood (1958), Michigan State University, East Lansing; Stanley E. Williamson (1959), Oregon State College, Corvallis. Also the following *ex-officio* members: John S. Richardson, *President of NSTA,* Ohio State University, Columbus; Glenn O. Blough, *President-Elect of NSTA,* University of Maryland, College Park; Richard H. Lape, *Treasurer of NSTA,* Amherst Central High School, Snyder, New York; Robert H. Carleton, *Executive Secretary of NSTA,* Washington, D. C.

Action

At the May 16 meeting of the Administrative Committee, the following program items were approved for FSAF action during the balance of 1956. The committee will meet again on October 3 and 4 to complete planning for the school year.

1. Science Teacher Recruitment. The continued popularity of the booklet, *Careers in Science Teaching,* has necessitated a fourth printing of 10,000 copies. Single or a few copies available free on request; quantity lots available at cost.

2. Career Information and Guidance Materials. The fourth edition of *Encouraging Future Scientists: Materials and Services Available in 1956-57* is now in preparation. Copies will be sent to all NSTA members; additional single or a few copies available free on request; quantity lots available at cost.

3. Mailing Service. Completion of a name list of the nation's junior and senior high school science teachers was authorized. Launched last spring, this project has now produced a list of over 25,000 names on coded punch cards. The list is available *at moderate cost* to all organizations and agencies for the sending of *approved* materials to science teachers.

4. Tomorrow's Scientists. This especially designed publication for science students will be continued through the fall months, at least, in a continued effort to find out whether such a publication is desired by teachers and students and whether enough subscriptions will be forthcoming to enable it to continue on a self-supporting basis. The first *(only)* fall issue will be sent to every science teacher on NSTA's membership and mailing lists, and the future of the publication will hinge on the subscription response.

5. Research. To provide a requested service to FSAF Sponsors and other business-industry groups, a fact-finding study will be carried out this fall to assess the plus and minus factors in the summer employment of science teachers in science-related jobs in industry and scientific laboratories. An effort will be made to identify patterns of practice, cautions and safeguards, and ways to assure maximum benefits to teachers and to employers. NSTA members who may wish to volunteer reports of their experiences and submit criticisms and suggestions are urged to do so.

6. Student Awards Programs. The 1957, sixth annual program of Science Achievement Awards for Students was approved. This will again be sponsored by and carried on under a grant from the American Society for Metals.

The FSA Chart-Making Contest for Students has been *discontinued.*

7. Summer Fellowships for Teachers. Reports of the 1956 West Coast Summer Conference for Science Teachers, sponsored by the Crown Zellerbach Foundation and Oregon State College, and the 1956 Summer Conference for Wisconsin High School Chemistry Teachers, sponsored by the Marathon Corporation, Lawrence College, and the Institute of Paper Chemistry, are now being prepared for publication in early issues of *TST*. About 70 teachers received Fellowships enabling them to participate in these conferences conducted by FSAF. It is expected that the number of conferences and Fellowships available next summer under the FSAF banner will be doubled.

Roster of Sponsors

The FSAF is supported financially by grants for general and specific purposes; these grants are pro-

vided mostly by business-industry organizations. We are happy to announce that the following have joined the Foundation's Roster of Sponsors since the May issue of *TST* went to press, thus bringing the total to 61 participating sponsors to date during 1956.

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Youth Wants To Know, the popular television program founded and produced by Theodore Granik, has announced its affiliation with the National Education Association. Hereafter, the NEA will cooperate in the production of the program, which is telecast each Sunday afternoon, from 3:30 to 4:00 p.m., EDT, over the National Broadcasting Company's television network. "Proud to be identified with the NEA on the eve of its 100th Anniversary" was the way Theodore Granik announced the new affiliation.

Please mention THE SCIENCE TEACHER when you write.

STOLLBERG—continued from page 228.

and superficial restatement of the Dewey-Kilpatrick *et al* philosophy of "learning by doing."

There is yet another consideration to be made in terms of the psychology of learning. This pertains to "transfer of training." This notion was in high favor around the turn of the century. Acceptance of the principles of faculty psychology and formal discipline rested largely on the belief that what was learned in one situation was transferred to another situation in which it might find practical use. But the "transfer" idea was attacked by Thorndyke and others and fell into some disrepute.

Accordingly, if we expect the results of problem-solving teaching to be applied in the daily lives of boys and girls and men and women, we must teach with this goal specifically in mind. We must make many references to real-life situations and constantly point out applications in facing difficulties in everyday living. And we must arrange the features of the learning situation (in school, for example) so that they correspond closely to the features of the situation where we hope problem-solving will be applied (at home, at play, for example). This principle has powerful implications in terms of using problem-situations actually encountered by children, in contrast to those artificially imposed by the teacher.

One final point about education for problem-solving should be emphasized. These remarks are addressed primarily to science teachers. It does appear that science has a rather special opportunity to encourage growth along these lines. But there is nothing in the above remark which indicates that problem-solving teaching is the exclusive property of science. On the contrary, there is much that other subjects can contribute.

What Might Happen If—

What are the implications of these ideas when translated into terms of actual classroom practices? If the thesis of the foregoing remarks were taken seriously, how would classroom procedures differ from those typical of so many schools today? It is suggested that in relation to the curriculum:

(1) There would be a stronger trend toward basing the curriculum on the needs and interests of the children.

(2) There would be an increased emphasis on helping children use democratic processes to help select and plan their learning experiences.

(3) There would be continued and increasing endeavor to integrate science instruction more satisfactorily with other aspects of the school curriculum.

In relation to educational objectives:

(4) Increased emphasis would be placed on such objectives as growth in problem-solving ability and desirable skills, attitudes, and habits rather than exclusive stress on factual information.

(5) Objectives of science education related to knowledge would emphasize broad generalizations and important principles rather than memorization of specific facts.

(6) Educational objectives would not be uniform for all children; rather, learning goals would depend more on the individual.

And in relation to procedures of instruction and evaluation:

(7) There would be added attention to project-type activities centered around individuals and small groups of students.

(8) Insofar as possible, science learning would take place with simple and familiar materials commonly found in the school, home, and community.

(9) Evaluation of instruction would be based on the progress children make as well as on their level of achievement.

In Conclusion

One final word: The pith of this argument is that problem-solving ability is a supremely important objective of science education. But its basic nature is often misunderstood, and as a result, efforts to achieve that goal often fall far short of the mark. The real tragedy, however, seems to be that all too little professional attention is devoted to the matter. This is particularly true of intensive research in the field. True, the literature abounds with opinions about problem-solving, and with descriptions of classroom situations aimed at the realization of this objective. Yet the quality of genuine research in the field is disappointingly small.

We in science education must give more attention to the development of problem-solving know-how. We should seek improved understanding of its true character and greater emphasis on its role in science teaching. And we need research, large quantities of it, to explore and improve methods of teaching and evaluating the use of ability to deal with everyday difficulties in all our lives.

If we neglect our responsibility, our profession, and our schools, our students will be the losers. But if we accept the challenge, we can help today's children and youth gain possession of the "Precious Gem of Science Teaching."

LOWE—continued from page 240.

called for inoculation of second-grade children and concurrent observation of first- and third-grade children who served as the control group. Another plan involved nearly twice as many children. In this test, children in the first three grades were inoculated; only half of them received vaccine, however, the other half receiving an ineffective fluid or control solution. In the latter test, only health authorities were aware of the differentiation; this arrangement was made to eliminate emotional and irrational attitudes and outcomes in children and parents.

Thus the hypothesis was tested. Experimentation and observation employed about 1,830,000 samples (school children), a single variable (polio vaccine), and a large control group who received "dummy" shots or no shots at all.

The conclusive proof of the hypothesis and of the value of this vaccine in preventing paralytic polio lies in the outcome of an evaluation which was and is now directed by Dr. Thomas Francis of the University of Michigan. His first major report concluded that the vaccine was 60 to 80 per cent effective against paralytic polio. The percentage differentiation in effectiveness is with regard to the three virus types and their respective disease manifestations. Continuing study will be made by the evaluation team to determine long-term comparisons of the test groups of children. Meanwhile, a national mass vaccination program is under way in all communities.

Research on improved vaccine continues in laboratories across the country. New questions continue to arise. Is killed virus vaccine as effective as live virus vaccine? Can live vaccine be used safely? If so, under what circumstances? These questions indicate a few of the directions to be taken in future research.

The children who participated physiologically in the building of evidence on which the trial vaccination experiment depended also react with curious minds, asking the "how" and "why" of the experiment in which they played such an important part. Herein lies an opportunity to develop a pattern of logical thought and reason in a subject which is very close to all children and parents.

Educators Guide to Free Slidefilms is newly revised and the 1956 edition (eighth annual) lists 631 titles including 38 sets of slides. A cyclopedic service, the book is intended for supervisors, visual education directors, teachers, and librarians. Obtainable from Educators Progress Service, Box 497, Randolph, Wisconsin. Price $5.00.

Book Reviews

GREAT EXPERIMENTS IN BIOLOGY. Edited by M. L. Gabriel and S. Vogel. 313p. $3.75. Prentice-Hall, Inc., New York. 1955.

This book is an anthology of excerpts from the writings of some 63 scientists of international reputation whose investigations have pushed back horizons and opened new doors to further research in the biological sciences. Many of the selections are translations from other languages.

The excerpts are grouped under seven headings: The Cell Theory, General Physiology, Microbiology, Plant Physiology, Embryology, Genetics, and Evolution. A "chronology" for each division serves as a time-line for the papers included. Each excerpt is introduced by a complete title and the source of the "paper" from which it was taken, and is preceded by a brief statement explaining the significance of the findings reported. Further elucidations and emphases are given through footnotes to the excerpts themselves. The book is indexed by subjects and authors.

Each of the 63 papers represents, if not a milestone, at least an important signpost along the way of man's exploration of life phenomena. This book will be a valuable addition to the personal library of every biology teacher for study, for reference, and possibly, for use as an effective "tool" in the teaching of biology.

ZACHARIAH SUBARSKY
The Bronx High School of Science
New York, New York

SEEING AMERICA'S WILDLIFE IN OUR NATIONAL REFUGES. Devereux Butcher. 338p. $5.00. The Devin-Adair Company, New York. 1955.

Mr. Butcher has produced a book full of information and nicely illustrated with numerous black and white photographs of birds (predominant) and mammals (abundant).

The first 24 pages present a condensed history of wildlife on this continent, the story of the development of our refuges and of the pressures against them. The author is avid in his condemnation of hunting, trapping, and other activities which threaten the natural existence of wildlife.

The body of the book deals with 41 of our National Refuges. Briefly given are: location, size, habitat types, vegetation, resident and migratory bird life present, and the mammal species found. Methods of reaching the refuge, addresses of headquarters, and information on nearby accommodations are also supplied.

The book concludes with a map of the National Wildlife Refuges, a section of descriptive information on National Parks and wildlife sanctuaries (public and private), a chapter on birds and mammal species in danger of extinction, a list (by states) of Fish and Wildlife Service refuges not otherwise mentioned, and other reading.

A good book for pleasure and for trip planning.

HERBERT WISNER
Unadilla Central School
Unadilla, New York

GENERAL SCIENCE FOR HIGH SCHOOL. Donald H. Painter and George J. Skewes. 702p. $2.61. Mentzer, Bush and Company, Chicago, Illinois. 1955 (Revised Edition).

If you are selecting a modern ninth-year general science textbook, be sure to consider *General Science For High School*. The reviewer would enjoy an opportunity to use this stimulating book with a group of enthusiastic students.

The approach is simple and logical, the way it should be, beginning with the conventional topic, Air Pressure, and ending with Safety. This well-balanced content includes the physical, chemical, astronomical, biological, and earth sciences presented in a conversational style of writing. The subject matter appears to be well chosen to meet the needs of the average ninth-grade boy and girl.

As an aid for understanding and enriching the content, the authors have included such teaching helps as topic previews, practical applications with their basic principles, historical briefs of scientists, learning experiences incorporated in the text, stimulating questions, summaries, and a complete glossary. However, the reviewer feels that if a selected bibliography could be included, it would develop a deeper appreciation of our scientific age.

Teachers and students will enjoy the correlated photographs and will find the many line drawings appealing, exceptionally clear, carefully chosen, and strategically placed. Both publisher and authors are to be commended for an excellent job of book designing and writing.

MAITLAND P. SIMMONS
Irvington High School
Irvington, New Jersey

CHEMISTRY IN ACTION. George M. Rawlins and Alden H. Struble. 591p. $4.40. D. C. Heath and Company, Boston, Massachusetts. 1956 (Third Edition).

This latest revision of a popular text should meet the needs of high school chemistry teachers who have been searching for a textbook of interest and value to several types of students. It should be equally satisfactory for those bound for college and those who wish to better understand their environment and the contributions of chemistry to better living.

The use of large, legible type and the two column format makes this book easy to read. It is organized into nine units and 47 chapters, with a total length somewhat shorter than most high school chemistry texts. However, it offers a thorough and complete one year course.

Students should find this book most helpful in mastering the theoretical principles of chemistry. The concepts are presented in a logical sequence with an abundance of useful aids in the form of well-chosen photographs, line drawings, tables, and excellent summaries. Realizing that many students have some difficulty with mathematics, the authors have been particularly careful to explain in step-by-step detail those parts of chemistry in which mathematics is a vital factor.

Throughout the authors have maintained a nice balance

between the technical aspects of chemistry and the application of chemistry theory to everyday industrial products and processes. A pleasing feature of the book is the up-to-date treatment of the newer developments in chemistry. The discussions of such topics as man-made elements, atomic energy, insecticides, silicones, synthetic fibers, plastics, and rubber substitutes are presented in an interesting and understandable manner. Many teachers will be pleased to find more than the usual space devoted to the realm of organic chemistry. This seems appropriate since the chemistry of man's body, his food, clothing, and shelter, and many of the newer developments in chemistry are primarily organic.

In the appendix many useful features have been added. Among these are an extensive glossary of technical terms, a rather complete table of chemical names and formulas for common household materials, and a section on materials for enriching the teaching of chemistry. In this section there is a listing of books, pamphlets, and periodicals recommended for supplementary reading. There is also a most complete and up-to-date listing of motion pictures for each unit.

Students who have the opportunity of studying chemistry from this text should thoroughly enjoy their course and gain an understanding of the role of chemistry in the improvement of the American way of life.

WALTER E. HAUSWALD
Sycamore High School
Sycamore, Illinois

SCIENCE FOR MODERN LIVING SERIES: SCIENCE ACROSS THE LAND (Grade 4), SCIENCE THROUGH THE SEASONS (Grade 5), and SCIENCE BENEATH THE SKIES (Grade 6). Victor Smith and Barbara Henderson. J. B. Lippincott Company, Chicago, Illinois. 1956.

A reader series that follows Betty and Bob through many science experiences. At each grade level there are a science excursion, experiences with living things, and a discussion of a phase of space study. Units about electricity and sound are included on the fourth grade level; chemistry, airplanes, the seasons, and health on the fifth grade level; and health, weather, light, and conservation on the sixth grade level. In each volume there are about ten units with a summary of basic concepts, suggestions for experiments, thought-provoking questions, and an objective test of key words at the end of each unit. The illustrations are numerous and clear with many in color. Of special interest is the extensive self-pronouncing glossary found in each book. The cover is attractive; the paper and binding durable.

MRS. GRACE WILLIAMS
Washburn Elementary School
Cincinnati, Ohio

BUILDING HEALTH. Dorothea M. Williams. 431p. J. B. Lippincott Company, Chicago, Illinois. 1956 (Second Edition).

This interesting, well-written, junior high school book stresses mental and social well-being as well as physical health. Subjects included are growth and development, changes that are normal in growing up, problems of body structure, good health habits, reasons for behavior, and suggestions for getting along with others. Each unit is complete in itself and may be used in sequence or otherwise.

An unusual feature is the picture preview at the beginning of each chapter, which provides for stimulating teacher-pupil planning. Illustrations are plentiful, well-labeled, and conveniently placed in relation to the reading material. A review test, committee planning, reference books, and film suggestions are included at the end of each chapter. Many words which may be new to junior high school students are explained in the context. The book is well-indexed and has a glossary.

VIRGINIA A. PARSONS
Roosevelt Junior High School
Charleston, West Virginia

SCIENCE FOR TODAY AND TOMORROW. Herman and Nina Schneider. 374p. $2.44. D. C. Heath and Company, Boston, Massachusetts. 1955.

This book, the sixth in an elementary science series, contains subject matter easily within the reading range and interest of sixth grade youngsters. The factual material is presented in an interesting and challenging manner.

The experiments have high interest value and the simplicity of the directions makes the book particularly useful as a student reference or guide. Throughout there is emphasis on learning through doing.

A variety of uses can be made of the text, namely: it can be used as the "center" for a science program, or as a reference providing ample opportunities for developing student-centered experiences based upon problems of living initiated through pupil-teacher planning.

MARY JANE MCDONALD
Principal, McKinley School
Fond du Lac, Wisconsin

Audio-Visual REVIEWS

ANIMALS AND THEIR HOMES. 12 min. sound, 1955. $55 B & W, $100 Color. Coronet Instructional Films, Coronet Building, Chicago 1, Ill.

Recommendation: Suitable for use in elementary grades in areas of science and language arts.

Content: Various types of animal homes with illustrations of them as protected places for rearing the young are shown. The location, materials used in building, and the protection afforded by the home in relation to the environment of the animal are some of the concepts presented. Animals shown and discussed are the duck, grebe, beaver, stickleback, rabbit, horned lark, robin, eagle, squirrel, gopher, prairie dog, wasp, and cliff swallow.

Evaluation: The organization and commentary add to the value of the film; the photography is good, and the film should stimulate interest and reading.

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THE CLOUDS ABOVE. 9 min. sound, 1948. $50 B & W, $100 Color. Bailey Films Inc., 6509 DeLongpre Ave., Hollywood 28, Calif.

Recommendation: Elementary and junior high school science and nature study areas.

Content: The film, which points out the importance of clouds to the city dweller as well as the farmer, fisherman, and aviator, first presents the more common types of clouds and then explains how they are formed by air picking up water vapor. Animated sequences trace the water cycle.

Evaluation: Good commentary and photography, with added effectiveness in color which should appeal especially to lower grades.

◇ ◇ ◇

MAKING A BALANCED AQUARIUM. 11 min. sound, 1955. $55 B & W. Coronet Instructional Films, Coronet Building, Chicago 1, Ill.

Recommendation: Intermediate and junior high school science and nature study areas.

Content: As Bob and Jynn make a balanced aquarium in a glass tank, they demonstrate the step-by-step procedures of collecting soil and river gravel, pond weeds, and fish, and the correct methods for placing each in the tank.

Evaluation: Good photography and content. The film, which has a musical background, was made in England by Plymouth Productions, Ltd. and is definitely English in nature which tends to detract from the film's full value. A teacher's guide is included.

LIFE IN THE OCEAN. 15 min. sound, 1955. $75 B & W, $150 Color. Film Associates, 10521 Santa Monica Blvd., Los Angeles 25, Calif.

Recommendation: Elementary and junior high school science and nature study areas.

Content: Photographed at the Marineland of the Pacific, the film tells the graphic story of plants and animals native to the ocean shore, its shallow water, and its depths. Their relationships with each other and to their environment are described, and comparisons are made with the habits of similar living forms found on land. The sea animals depicted are diatoms, seaweeds, sea fan, sea star, sea cucumber, cowrie, turtle, sea lion, and porpoise.

Evaluation: Excellent photography and content, good narration. In color, the close-up views and motion shots of the various animals are exceptional.

◇ ◇ ◇

REPTILES ARE INTERESTING. 10 min. sound, 1955. $50 B & W, $100 Color. Film Associates, 10521 Santa Monica Blvd., Los Angeles 25, Calif.

Recommendation: Intermediate, junior high, and senior high school nature study and science areas.

Content: This film, photographed at the San Diego Zoo, deals with the crocodilians, turtles, lizards, snakes, and the group represented by the tuatara—all reptiles, which are among the oldest of the true land animals with backbones. Pointing out that only a few are poisonous and dangerous, the film demonstrates that most reptiles are beneficial to man and should not be killed needlessly.

Evaluation: Well-organized content and commentary, presented with exceptional clarity; close-up and color photography are excellent. A teacher's guide comes with the film.

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SLOW AS IN SLOTH. 21 min. sound, 1955. $155 Color. Moody Institute of Science, 11428 Santa Monica Blvd., Los Angeles 25, Calif.

Recommendation: Senior high school and adult groups.

Content: Introducing the sloth as a creature of crossword-puzzle fame, the film then presents the animal in its natural surroundings and deals with such factors of its ecology as its food supply, natural enemies, defensive mechanisms, and locomotion. The study was filmed at Barro Colorado Island, in Gatun Lake, Panama Canal. The two-toed and three-toed sloths are compared, and, by contrasting facts revealed by the truth-telling camera-eye with statements made in an early naturalist's description of the animal, the film emphasizes the folly of careless research.

Evaluation: The material and photography on the sloth itself are excellent. By demonstrating the need for withholding a conclusion until all facts are known, the film also teaches proper scientific techniques. A teacher's guide is included.

Activities of NSTA AFFILIATES

► The Science Section, Alabama Education Association and the Arkansas Science Teachers Association have recently joined the roster of NSTA affiliated groups. National, state, and local NSTA affiliates now total 71.

► The Chesapeake Section of the American Association of Physics Teachers has inaugurated a scholarship program for seniors in high schools of Delaware, Maryland, Virginia, and the District of Columbia. Ten colleges awarded scholarships on the basis of competitive examinations. The Chairman of the program is Dr. Bernard B. Watson of the Operations Research Office, Johns Hopkins University.

► The Illinois Association of Chemistry Teachers will hold its next meeting October 19, on the campus of the University of Illinois at Urbana. The program is being planned by Dr. Carl Westherbee, President of the organization, and Dr. B. Roher Ray, who is on the chemistry staff of the University of Illinois.

► The Fourth Annual Conference of the Pennsylvania Science Teachers Association held in July had as its theme, "Science for Defense." Dr. Ellsworth Obourn of the U. S. Office of Education delivered the keynote address at the opening session. Field trips to research laboratories of Pennsylvania State University were arranged. Participants also attended discussion groups on conservation, elementary science, certification, and meeting student needs.

► The Science Teachers Association of New York State held a summer conference at the State University Teachers College at New Paltz. The three-day meeting included a panel discussion on the topic, "Needed, More and Better Scientists." Specialized sessions and field trips to nearby places of interest were also provided.

► The Secondary Science Section of the Virginia Education Association is launching a periodical publication. The first issue is now in preparation. Other Science Section programs include a study to determine optimum and minimum requirements for equipment necessary for successful high school science teaching and a project to form a policy for the evaluation of science textbooks.

Please keep us informed and up-to-date on the activities of your affiliated group so that your organization can be included in this column. If your science teacher association is not an affiliate and would like to share the benefits of exchanging ideas with NSTA and other groups, please write NSTA headquarters for further information on NSTA affiliation. Editor.

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